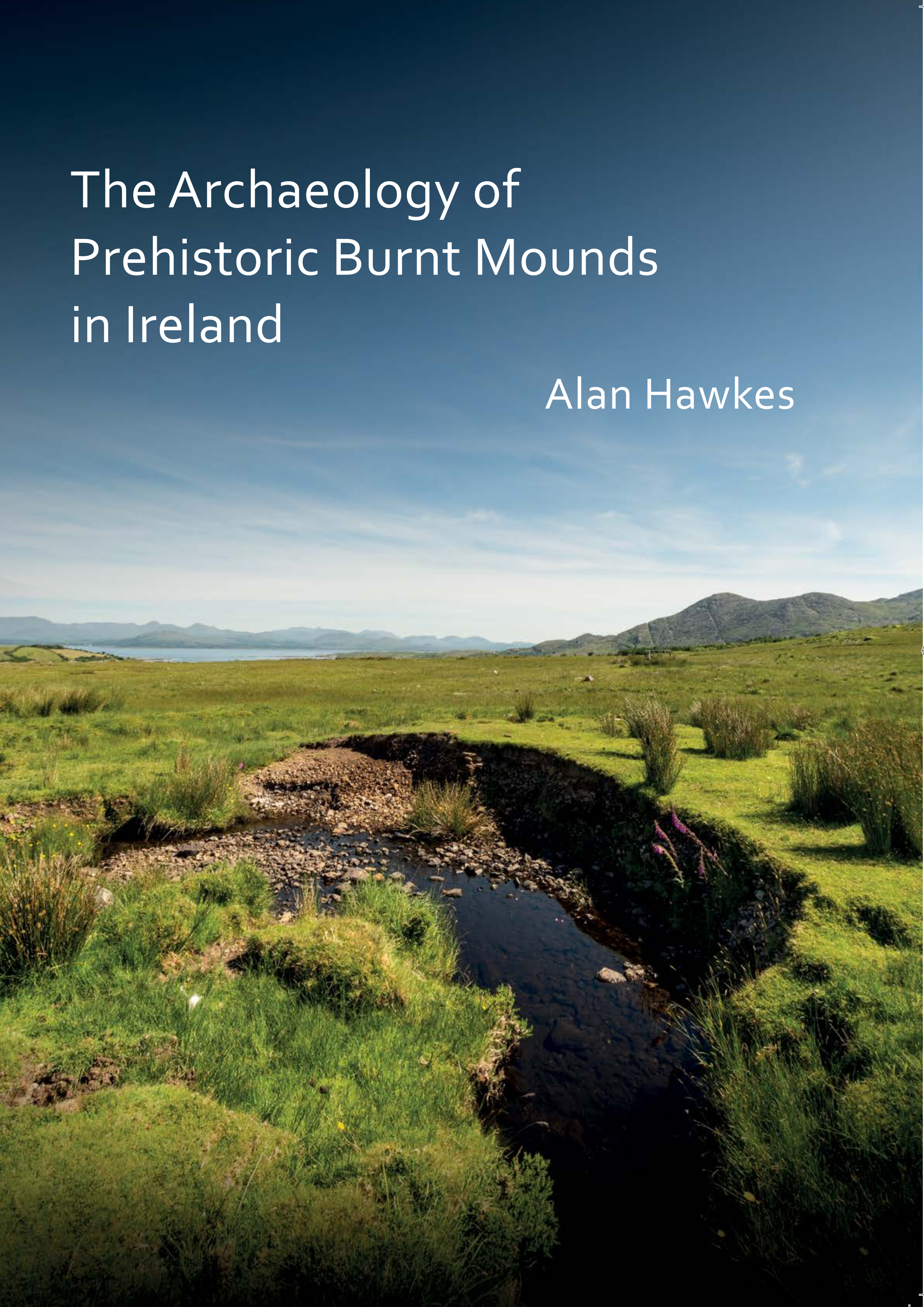
The Archaeology of Prehistoric Burnt Mounds in Ireland

Alan Hawkes



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Archaeopress Archaeology

Archaeopress Publishing Ltd
Summertown Pavilion
18-24 Middle Way
Summertown
Oxford OX2 7LG

www.archaeopress.com

ISBN 978 1 78491 986 3
ISBN 978 1 78491 987 0 (e-Pdf)

Cover: Nick Hogan
Front cover: Burnt mound (SMR: CO102-005013) in the townland of Ardgroom Outward, Co. Cork (Photo: Nick Hogan)
Back cover: Top – bottom: Drombeg stone-lined trough (Photo: Edward Fahy, courtesy of Dan Breen); reconstructed cooking trough and burnt stone mound (Photo: author); excavation of a trough at Bockagh, Co. Roscommon (Photo: IAC Ltd); heat-shattered/affected stone (Photo: author)

Printed in England by Oxuniprint, Oxford

This book is available direct from Archaeopress or from our website www.archaeopress.com

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Acknowledgments

First and foremost, I would like to thank my PhD supervisor, Professor William O'Brien, for his encouragement and unwavering support throughout, not only during my time as a student but also in my early post-graduate career. I would especially like to acknowledge his careful reading of the text and the many improvements made as a result. The financial and technical support provided by the Department of Archaeology, University College Cork is also acknowledged, without which this study and subsequent book could not have been possible. Thanks also to the staff of the Department, in particular Rose Cleary, who gave invaluable assistance and advice from the very beginning and Nick Hogan for designing the cover of the book, helping with the illustrations and contributing a great deal in terms of technical advice and support. I would also like to acknowledge my PhD examiner, Professor Richard Bradley for recognizing the value of the study and encouraging its full publication.

I wish to also thank the relevant archaeological companies and excavation directors who supplied photographs for the book (see captions for credits) and gave freely of their time to discuss their excavations with me. In particular, I would like to thank Agnes Kerrigan, Avril Purcell (Lane/Purcell Archaeology), Catherine McLoughlin, Conor MacDermott, Cotswold Archaeology, Daniel Breen, Diarmuid O Drisceóil, Dominic Delaney, Donald Murphy (ACSU Ltd), Eamonn Cotter, Emer Dennehy, Fintan Walsh (IAC Ltd), Graham Hull (TVAS Ireland), Ian Russell, Jacinta Kiely, Joanna Nolan, Joe Nunan, John Tierney (Eachtra Archaeological Projects), Judith Carroll (Judith Carroll & Company), Kevin Martin, Kieran Campbell, Liam McKinstry, Maire Ní Loingsigh, Margaret Gowen, Matt Mossop, Dr Maurice Hurley, Neil Jackman, Richard F. Gillespie (Mayo County Council), Rose M. Cleary, Shane Delaney (IAC Ltd), Sheila Lane (Lane/Purcell Archaeology - formally Sheila Lane and Associates), Siobhan McNamara, Steven Mandal (CRDS Ltd), Tim Coughlan (IAC Ltd), Trish Long (Rubicon Heritage), VJK Ltd, and Yvonne Whitty. My sincere thanks to the National Monuments Service and Transport Infrastructure Ireland (formally the National Roads Authority) who helped enormously with providing final excavation reports, particularly, James Eogan, Martin Jones, Ronan Swan and Ken Hanley. My gratitude also to Dr James O'Driscoll, Dr John Ó Néill, Dr Aimeé Little and Dr Kerri Cleary. I also wish to express my appreciation to David Davidson and the team at Archaeopress for their patience and believing in the publication.

A special thanks to my partner Joanne for her help in editing the text and her understanding and patience throughout the time I took to complete this publication. A final thanks to my parents for their lifelong encouragement of my education - I dedicate this book to them.

Preface

The ability to control fire has continuously developed over the long history of human evolution. Modern humans and preceding hominins have used fire since the Lower to Middle Pleistocene, dating as far back as 200,000 to 1 million years ago (see Wu 1999; Goren-Inbar *et al*., 2004; Zhong *et al*., 2014; Gao *et al*. 2014). However, the discovery of Upper Paleolithic burnt stone deposits at El Mirón Cave, Spain along with similar deposits at Shuidonggou, near Yinchuan, China, indicate that humans ability to control and use fire underwent considerable change *c.*15-10,000 years ago, evolving from direct contact between fire and a heated object to indirect heat transfer using hot stones (Nakazawa *et al.* 2009; Gao *et al*. 2014).

The stone represents the waste-firing material associated with a 'pyrolithic' technology, where stones were heated and then rapidly cooled through immersion in cold water, although features employing dry heat are also known in the archaeological record. The antiquity and utility of pyrolithic technology is attested to by the presence of burnt stone in archaeological sites dating back thousands of years. Ethnographic records from different parts of the world illustrate the importance of using hot stones. This technology was commonly used in cooking facilities to indirectly cook food via stone boiling, earth oven baking and griddle roasting, while hot stones were also used to provide heat in shelters.

While pyrolithic technology was in wide use since the Upper Palaeolithic, in Ireland it is particularly associated with water-boiling during the Bronze Age. The method involved a process of heat transfer whereby water was boiled in sunken pits (troughs) through the introduction of stones heated in a nearby fire. The heat transferred directly from the stones, raising the water to the necessary temperature. After numerous re-firings these stones eventually shattered by the heating/cooling process, and gradually accumulated near the trough to form a low mound or spread that contained large amounts of charcoal. These *fulachtaí fia*, as they are known in Ireland, are recognised in the field as crescent-shaped mounds of burnt stone, or are exposed in plough-soil as spreads of burnt stone mixed with charcoal-enriched soil. With an estimate 7000 examples known, it seems that Ireland was the most prolific user of pyrolithic technology in Bronze Age Europe.

This book presents and discusses the archaeology of burnt mounds in Ireland. These deposits have been regarded as somewhat enigmatic, described by one researcher as 'one of the most boring sites with which a field archaeologist must deal' (Barber and Russel-White 1990: 59). Burnt mounds are prominent in the literature, yet most discussions have been based on a small sample of the available evidence. This has happened for two reasons. The first is that the number of excavations has increased considerably as a result of development-led archaeology over the past twenty years. The other is that the results of relatively few of these projects have been published, mostly site specific outputs focusing on the excavated features rather than clear interpretive discussions.

The book presents a re-evaluation of the burnt mound phenomenon in light of some 1000 sites excavated in Ireland. This is the most comprehensive study undertaken on the use of pyrolithic technology in prehistoric Ireland, dealing with different aspects of site function, chronology, social role and cultural context. A number of key areas have been identified in relation to our understanding of these sites. Previous investigations of burnt mounds have provided little information on the temporality of individual sites. It has been established that appropriate sampling strategies can provide important information about the formation of individual sites, their relationships to each other and to other monuments in the same cultural landscape. The evidence suggests that considerable caution should be exercised with regard to certain single radiometric dates from burnt stone deposits, based on the association between the dated sample and the pyrolithic activity in question. Previously regarded as Bronze Age in date, there are now numerous examples of pyrolithic-type processes in earlier contexts, with the origins of the water-boiling phenomenon now considered to lie in the Early Neolithic period.

A review of recent excavation evidence provides new insights into the use of pyrolithic technology for cooking. This is based on the discovery of faunal remains at several sites, combined with insights gained through experimental studies. The model proposed here is of open-air communal feasting and food sharing hosted by small family groups, as a medium for social bonding and the construction of community. It is also argued that if cooking was the primary activity taken place at these sites, this should not be viewed as a mundane functional activity, but rather one that actively contributed to the constitution of social relations.

Alan Hawkes 2016

Chapter 1

Burnt mounds: an introduction

Spreads and low mounds of burnt stone and charcoal-enriched soil, are one of the most common types of site found in prehistoric landscapes. They represent an accumulation of firing material associated with a pyrolithic technology, which involved a process of heat transfer that centred on the use of hot stones immersed in water-filled troughs or placed in small, lined/unlined pits/ovens. Hot stones were also used to generate steam for sweat-bathing, a practice widespread in many parts of the world in prehistoric and later times. The use of this technology extends back tens of thousands of years to when humans began to control and manipulate fire for the purpose of heat transfer. It gradually evolved to play and important role in the development of cooking procedures in many parts of the world, where hot stones were used for prolonged cooking by roasting, steaming and boiling in different types of pits. Through thermal conduction, stones capture and hold the heat generated by fast-burning fuel that would otherwise dissipate before many foods could be cooked over open flames (Thoms 2008; 2009). The use of these 'indirect' methods of cooking did not mean the replacement of older 'direct' methods. While more costly techniques, such as pyrolithic water-boiling (in terms of heat expended and labour invested), were occasionally used in certain societies, less costly, open-fire methods continued to be used for easily cooked foods.

In Bronze Age Ireland, pyrolithic water-boiling was particularly popular, with material from this process purposefully deposited in small crescent-shaped mounds, usually adjacent to a convenient water source such as a stream, river or spring. These burnt mounds have been the subject of archaeological enquiry since the early 1800s in Ireland. Designated '*fulacht fiadh*', they were described as ancient cooking places or 'deer roasts' (Hackett 1854); an interaction supported by references to apparently similar sites in early literature, notably, Geoffrey Keating's *Foras Feasa ar Éirinn* (Dineen 1908). Their wider cultural meaning remained largely unexplored until the 1980s (Ó Drisceoil 1988; Buckley 1990).

During the early 1990s, burnt mounds acquired an unfortunate name as one of the 'most boring sites with which a field archaeologist must deal. Apart from new data and a new spot on the distribution map, individual sites have little to contribute to our understanding of the past' (Barber and Russel-White 1990: 59). This viewpoint probably still illustrates a general attitude of many field archaeologists working in Ireland and Britain. This is partly due to the perceived similarity of these sites when excavated and the general absence of diagnostic material culture. Of most relevance, however, are problems relating function, first remarked upon by Rev. Richard Smiddy who observed that; 'The name *folach fiadh* is well known to the country-people: and they bestow it on a heap of burnt stones, of which, as a rule, they know neither the origin nor the use' (Smiddy 1873: 52). Despite the level of investigation and experimentation that has taken place, the ambiguities surrounding these sites have remained. In fact, the myriad of functional theories now apparent in the published literature has resulted in burnt mounds being, rather unhelpfully referred to as the 'kitchen sink of the Bronze Age'. The picture that has emerged is one of a multi-period site of a multi-functional nature associated with mundane water-boiling tasks. As such, burnt mounds have not been incorporated into wider discussions on prehistoric archaeology and have rarely featured in syntheses of the European Bronze Age.

During the past 15 years, an upsurge in excavation led to renewed interest in the Irish burnt mound phenomenon (Ó Néill 2009; Hawkes 2012; 2014; 2015). They have become one of the best known and most frequently excavated site types in Ireland, largely as a consequence of numerous discoveries made in course of road building. By 2010 an estimated 1200 sites have been excavated, with some 900 as a result of infrastructure development, making this the most common archaeological site discovered during infrastructure and other projects. Much of this evidence excavation record can be regarded as 'grey literature', as most of these sites have not been published in a comprehensive manner. Even though this is slowly being amended through publication initiatives by Transport Infrastructure Ireland and other bodies, there has been no comprehensive review of the new dataset. This book will examine this new evidence for a site type known not only in Ireland but also in other parts of northern Europe. The compilation of this site information provides a better understanding of the archaeological record, and allows for a detailed analysis of the function and social significance of these sites, along with their chronological and cultural affinities.

While numerous site reports are available, there have been relatively few general studies of burnt mound archaeology in Ireland. M.J. O'Kelly's seminal paper in 1954 remains one of the most important early studies of burnt mounds in Ireland. In recent years the International Burnt Mound Conference would provide a forum for more open debate on matters relating to function (Buckley 1990). John Ó

Néill (2009) was the most recent researcher in Ireland to study the beginnings of the growing excavation record and was the first to explore the different processes involved in 'pyrolithic technology'. His work would also highlight the emerging trend among developers and archaeologists at that time, who were beginning to regard burnt mounds as somewhat generic and devoid of new information (Ó Néill 2000a).

1.1 PYROLITHIC TECHNOLOGY AND THE IRISH BURNT MOUND

In Ireland, the pyrolithic phenomenon is mainly associated with burnt mounds or *fulachtaí fia*, where it is generally assumed that a hot-stone, water-boiling technology was employed to heat water held in open-air sunken pits (O'Kelly 1954; Waddell 2000; Ó Néill 2009). They are usually situated in low-lying, poorly drained, marginal land close to a water source, such as a river, stream, spring, pond, lake, turlough bog or marshy area (O'Kelly 1954; Ó Drisceoil 1980; 1989; Waddell 1998; Grogan 2005; Ó Néill 2009). While the majority of sites are generally located at lower points in the landscape (0–60m OD), associated with poorer soils (Grogan *et al.* 2007: 88) some examples are known in upland areas (100–200m OD) (see O'Brien 2009), though rarely above 200m OD.

These sites are marked by the presence of one or more low mounds or spreads of heat-shattered stone and charcoal. This material often overlies one or more pits used as a water trough, along with accompanying hearth (s). Other features regularly found at these sites include wells and water-drainage features, pits, platforms/working surfaces, revetments, ancillary structures and trackways (see Chapter 4). The stones thermally fractured by repeated firings, followed by immersion in cold water, until they gradually disintegrated beyond a useable size. The resulting stone, along with the charcoal and remnants of the fire were removed from the trough and spread in the vicinity to form a low mound. The stony, free-draining nature of this burnt mound was not conducive to vegetation growth, with the result that they stand out clearly as grassy knolls in poorly drained areas (Figure 1.1). They have a varied form, but typically conform to a horseshoe shape. While the Archaeological Survey of Ireland does not account for the total number of extant burnt mounds in Ireland (with many considerably out of date), a significant sample is available for analysis. Of 1148 mounds described in the published archaeological inventories, 47% of sites exhibit a horseshoe, kidney or crescent shape, while 18% are circular, 17% irregular, 14% oval and 2% D-shaped. They range in size from 3–20m and are generally less than 1–2m in height (Figure 1.3). Situated in low-lying, poorly drained land, these mounds often occur in significant clusters, with groups of up to six or more being recorded, sometimes within a few metres of each other (Power 1990; Waddell 2000; Grogan 2005). While such clustering indicates a prolonged use of a particular location, little relatively is known of the temporality of this practise. Recent commercial archaeology projects have provided interesting results with regard to chronology, which has altered dramatically our understanding of such burnt mound concentrations (see Chapter 5).

Burnt mounds are the most numerous prehistoric site in Ireland, with recent indications suggesting that there are in excess of 7000 recorded examples (Figure 1.2). It is difficult to determine the true number as hundreds of unrecorded, levelled sites have been identified in recent years as a result of road building and other developments. They are most common in the south-west of the country, particularly in Co. Cork where some 3000 examples are recorded, occurring in a density of at least 1 per 3.7 sq. km (Ó Drisceoil 1987: 51; Buckley 1991: 3). It is likely however, that these densities are related to a bias in fieldwork rather than a genuine reflection of the distribution trends of the monument type.

Various terms are still used to describe these sites in Ireland. Hackett (1854: 59) observed they were known in Cork as '*Folacht Fia*' or 'Cooking Places', in Tipperary as 'Deer Roasts' and in Ulster as 'Giant Cinders' (see Chapter 2). The latter two terms do not seem to occur in the literature after the middle of the nineteenth century. The term '*fulacht fian*' has also been associated with a mythical band of warriors known as the Fianna. The latter term was popularised in the nineteenth century by Geoffrey Keating's text, *Foras Feasa ar Éirinn.* The name '*fulacht fiadh*' is a nineteenth-century invention meaning 'cooking place of the deer' or 'of the wild'. The word '*fulacht*' and its derivatives appear as a term relating to cooking from about the ninth century AD; however, early references are quite ambiguous and some have cautioned its use in relation to pyrolithic water-boiling (Ó Drisceoil 1990; Kelly 2000; Ó Néill 2005). The earliest recorded reference to the term '*fulacht*' occurred in Cormac's Glossary from approximately AD 900 (*ibid.*: 673). Many of the sources in which the term is found have their roots in oral tradition, making them difficult to date (Ó Drisceoil 1990: 157). Whether these early references refer to what we now class as burnt mounds is matter of continued debate (See Chapter 2; Chapter 5 and Chapter 8). Ó Néill (2005: 84) states that the true origin of the term might derive from words such as folach 'support' or fuil, fola 'blood' and may intentionally contain resonances of both. There is clearly an ambiguity in early Irish literature, whereby the references to this site-type are obscure and difficult to translate. Today, some archaeologists view the term '*fulacht fia*' as archaic, preferring to use 'burnt mound' in relation to pyrolithic technology.

The term 'boiling mounds', 'pot-boilers' and 'burnt mounds' are often reserved for similar British site-types, which are also characterised by mounds of heat-shattered stone and charcoal (Chapter 4). The term 'burnt mound' is increasingly applied to Irish examples, more so in recent years as a direct consequence of development-led projects. It is used in a broad sense to describe sites where charcoal-enriched soil and heat-altered stone is uncovered. Some researchers (e.g. Brindley *et al*. 1989–1990; Grogan *et al.* 2007) have used the term where a boiling trough or pit

Figure 1.1. Burnt mound at Turnaspidogy, Co. Cork (RMP CO081-044). Source: Alan Hawkes

is absent from the excavated site. 'Burnt spread' is also assigned to sites where a shallow spread of heat-shattered stone is uncovered, which may or may not overlie cut features. This can happen where the full extent of the site is not revealed; for instance, on a pipeline or road development.

Ó Néill (2009: 49) observed that any terminology must be based on the evidence provided by excavation. Where sites have not been excavated it is appropriate to use the term with least functional connotations (*ibid.*: 49). For Ó Néill, 'burnt mound' is the most neutral, and unlike '*fulacht fia*', does not suggest a particular function nor any pre-supposed connection to the historically documented tradition in Ireland. While this study confirms there is no archaeological evidence to support a burnt mound tradition contemporary with the historical sources (Hawkes 2012; see Chapter 5 and 8), it also revealed that the term '*fulacht*' and its derivatives refer to a cooking activity in some capacity, whether relating to cooking on a spit or in a boiling trough. With this in mind, it may be acceptable to continue with the term *fulacht fia* by reason of the literal translation of '*fulacht*,' meaning 'recess' or 'cavity' and '*fia(dh)*' meaning 'of the deer' or 'of the wild'; essentially, some form of outdoor activity relating to cooking in pits. The term 'burnt mound' has been used to distinguish sites without boiling pits. While terminology can provide a basis for distinguishing certain types of burnt mound site (Brindley *et al.* 1989–90), it does little to explain the differences now apparent in the excavation record. To avoid confusion, the term 'burnt mound' will be used throughout this book as a means to describe any site with a considerable deposit of burnt stone material, with or without accompanying cut features such as troughs.

The general consensus is that burnt mounds in Ireland were places were pyrolithic technology was practiced for the heating or boiling of water. The function of these sites, however, remains problematic due to the various applications of hot water. The lack of diagnostic material culture and faunal remains from most excavated sites also makes interpretation difficult. The suggestion that they were cooking sites is perhaps the most widely accepted of the many theories. Here, the primary purpose of the site was to cook food by means of heat-transfer from hot stones to water and then eventually to meat and other food. Due to the scarcity of food waste in excavated burnt mounds alternative suggestions have been put forward regarding their function, such as their use as bathing places or saunas, as well as brewing, textile-processing and leather working areas (see Chapter 6 for further discussion). In the absence of diagnostic artefacts, the dating of burnt stone deposits has mainly been approached through the use of radiocarbon dating. Anna Brindley and Jan Lanting

undertook a comprehensive programme of radiocarbon dating in the late 1980s, the results of which placed the use of most of these sites in the Bronze Age (Hawkes 2012). The large numbers of excavations in recent years, due to infrastructure and building developments has expanded the radiocarbon record for these sites.

1.2 BURNT MOUNDS: A NEW DIRECTION

O Néill (2009) was the first to recognise the potential for burnt mound research where large amounts of data might reveal answers to long-standing questions about the site type. Unfortunately many sites excavated during the Celtic Tiger years of commercial archaeology could not be included at the time of this research. The author's research has developed on O'Néill's important study to include new data coming from final reports including specialist information. The availability of this new information means this is the first study to consider the origins of the burnt mound phenomenon in Ireland, its use and social significance along with their relationship to contemporary settlement.

Research aims and Objectives

In addition to creating a comprehensive database of excavated sites, this study also aims to address the following:

(a) Burnt mound and infrastructure archaeology in Ireland

Over the past fifteen years burnt mounds and related deposits have been a major component of development-led archaeology in Ireland, with the likelihood that this will continue in future infrastructural schemes. Because they occur in large numbers with a range of similar features, there is a tendency within major infrastructural schemes to view burnt mounds as a homogenous group that add little to our understanding of prehistory. An analysis of excavation and sampling strategy employed on road and pipeline schemes will consider many problems associated with the investigation of these sites on such projects.

The range of excavated features in these sites will be studied with a view to understanding aspects of site formation. Whether all sites share the same basic characteristics and how variability in layout relates to function are two questions to be considered. Recent evidence suggests that the technology may have been used in different ways, with the result that morphologically similar site types employed similar pyrolithic techniques for different purposes. Burnt mound excavations have also produced evidence of activities carried out in a controlled, ordered environment. The structured deposition of mound material, the specific location of certain features and the control of water, suggests a level of design and maintenance that has not been explored in any detail. Questions of organization will be examined in relation to the occupation history and use of these sites.

(b) Chronology

This is a long standing issue in relation to burnt mounds. Prior to this study it was generally accepted that these sites have long use histories in Ireland, beginning sometime in the Early Bronze Age and dying out during the medieval period. There has been continued debate (O'Kelly 1954; Sheehan 1990; Walsh 1990; Edwards 1990; Brindley *et al.* 1989–1990) as to whether the tradition continues into the historic period, contemporary with the many of the early literary sources that describe similar processes. Radiocarbon dates from few sites have in the past been used to confirm that pyrolithic water-boiling continued into medieval times (Murphy and Clarke 2000; Ryan 1990). There has been a similar discussion of burnt mound chronology in Britain (Williams 1990: 134; Russell-White 1990: 75; Anthony 2003; Ó Néill 2009). With a large sample of excavated burnt mounds now available, these long standing questions on chronology can now be addressed. A critical analysis of new radiocarbon evidence will also shed some light on the origins and decline of this water-boiling technology in Ireland.

Researchers have generally ignored that these sites are commonly the product of many 'occupations'. There is relatively little information on the duration of individual sites. The nature of mound deposits generated by the use of pyrolithic technology means that detailed stratigraphic analysis is often not possible. Where evidence exists for multiple phases of use on a site, this is seen principally in the form of numerous pits and through the replacement, re-cutting and re-lining of troughs. The broader implications of these use-cycles will be explored, including the symbolic dimension to site histories and internal phasing, with the deliberate mounding of stone viewed as a creation of 'place' through culturally specific set of activities. It is, however, important to highlight the limitations imposed by archaeological methodologies, such as the difficulty in establishing the temporality of occupation. A site may have multiple lifecycles, however these might not always be recognisable due to poor stratigraphic differentiation and later disturbance. This is also complicated by the equivocal nature of the physical evidence, and the fact that the term burnt mound may cover a range of site types.

(c) Use and social significance

With some 7000 recorded burnt mounds, Ireland was probably the most prolific user of pyrolithic water-boiling technology in prehistoric Europe. Most discussions on the site type focus on function due to the many possible uses of hot water for everyday activities. In recent years, burnt mounds have been the subject of some controversy in popular media and academic circles. The large amount of data from recent excavations in Ireland has the potential to address long-standing research questions about site function. Although the cooking hypothesis is the most widely accepted, this has come under scrutiny due to the scarcity of food waste and artefacts. The recent discovery of animal bone assemblages at a number of sites provides

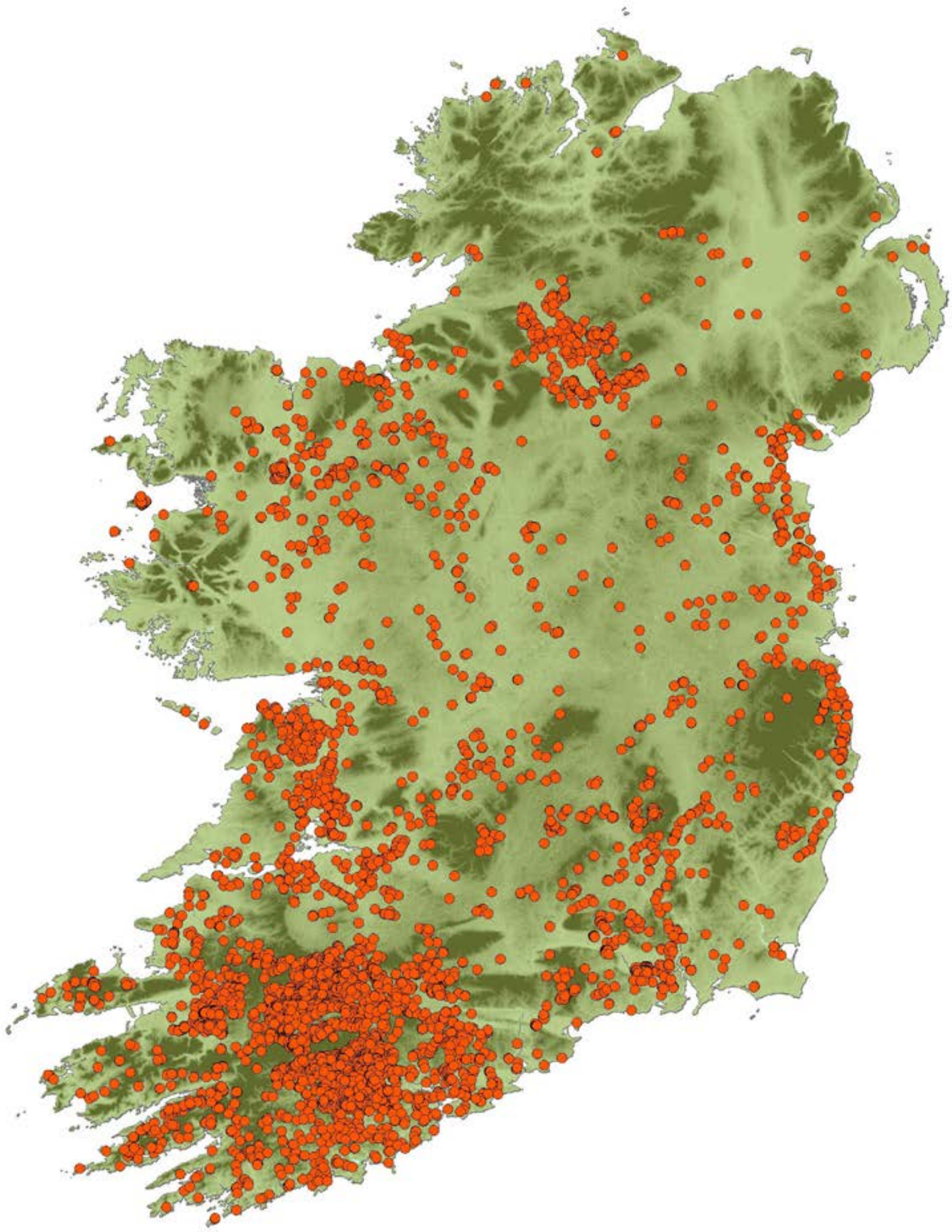

Figure 1.2. Distribution of recorded burnt mounds in Ireland. Source: www.archaeology.ie and www.doei.gov.uk.

an opportunity to review this aspect of their use, which was first alluded to by the historical sources and experimental work in the 1950s (O'Kelly 1954).

The social aspect of these sites will also be considered in this study. In Bronze Age Ireland the cooking and consumption of food was carried out using both direct and indirect methods. The latter involved the heating large amounts of water using hot stones. This represented a considerable social investment, requiring both organised labour and collection of raw materials. The laborious nature of the process suggests that cooking food in this manner may have been largely social, connected to special events and feasting. Their exclusive occurrence in specifically designated areas within the settled landscape suggests a clear separation, where particular places were selected for the application of water-boiling. This would also indicate that their use had a social function beyond the immediate occupants of a single settlement or house site.

(d) Settlement and cultural context

While burnt mounds cannot be described as residential sites, they are certainly an important element of local settlement landscapes in many parts of Ireland.

It was initially suggested that burnt mounds represented areas of transient settlement or temporary hunting camps (O'Kelly 1954), however this now appears to be untenable. The recent discovery of prehistoric settlements

Figure 1.3. Burnt mound at Mangerton, Co. Kerry (RMP KE084-044005). Source: National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

and house-sites in proximity to burnt mounds on many road schemes in Ireland provides an opportunity to examine the wider settlement context of these sites. Like other monuments, burnt mounds should not be examined in isolation, but rather as part of a landscape structured by accumulated meanings. This project will undertake a study of burnt mounds as proxy indicators of prehistoric settlement. The application of GIS software will be useful in landscape visualisation of burnt mounds in relation to contemporaneous sites.

The study will also address the cultural context of the burnt mound phenomenon in prehistoric Ireland. This includes those developments that led to the origins of pyrolithic technology, from its initial use in the later fifth millennium BC to its widespread application during the Chalcolithic and Bronze Age. The eventual decline of the tradition during the early stages of the Iron Age will be considered, along with the mythologizing of this tradition in early historic period. The aim is to understand how the technology was viewed and practiced across the different cultural spectrums and the possible functional changes that may have occurred as a result.

1.3 SOURCES OF INFORMATION

To address these research questions, this study will focus on the rich excavation record now available for burnt mounds in Ireland. Recent infrastructure development has brought to light a large number of new burnt mounds, which have begun to influence the perception of the site type and presents an opportunity to review some key issues. The objective was to collate the archaeological information obtained from these investigations on different infrastructural schemes and interpret this evidence within a broader landscape context. This project brings together evidence from 1165 burnt stone deposits excavated in Ireland during the period 1950–2010, and includes a large number of unpublished sites. The aim is to study the archaeology of these sites in detail, to observe the development of the technology over time. Particular emphasis is placed on understanding the chronology and use history of burnt mounds, along with the social use of this technology and its wider cultural context.

The initial stage of research involved a comprehensive review of all published sources with details of excavated burnt mounds. The aim was to achieve a complete overview of the published sites, using the relevant grey literature. The archives of Transport Infrastructure Ireland and the National Monuments Section of the Department of Arts, Heritage and the Gaeltacht were accessed. The *Excavations Bulletin*, which provides an index of all licensed testing or excavations in Ireland up to 2009, provided another valuable source of information for the project. The latter source has its limitations in that only a minority of entries

contain radiocarbon or dendrochronological dates, as the reports were often submitted before post-excavation analysis was completed. Where possible, the original excavators and relevant archaeological consultancies were contacted in order to obtain detailed site information.

All burnt mounds excavated in Ireland up to 2010 are considered in the study, using data from published and unpublished sources to create an up-to-date catalogue of these sites. Some initial issues addressed in relation to the collection of data for analysis were the geographical parameters that would determine the inclusion of individual sites. While the majority of recent infrastructural developments were undertaken in the Republic of Ireland, it was decided to extend the study to include sites excavated in Northern Ireland. In addition to sites excavated on recent infrastructural development, older excavations were also incorporated within the study to make the database comprehensive.

The selection of sites for the study is based on the presence of charcoal-enriched soil and burnt stone, as well as pits used as receptacles for either water-boiling or dry roasting. However, these criteria in themselves create certain problems. Heat-affected stone consists of fractured, angular and discouloured rock resulting from the intense heating and sudden cooling. As such, it is important to recognise that not all deposits of heat-shattered stones may reflect ancient pyrolithic processes as they can form in other ways (see Chapter 4). Infrastructure archaeology has led to the discovery of different site types employing a similar technology, including those that seem to be short-term sites surviving as spreads of burnt stone and charcoal. Most are interpreted as 'destroyed' burnt mounds, truncated and removed by later agricultural processes. A number of these sites were of short duration, and as such did not form substantial mounds of burnt stone. These sites have not been given the significance they deserve. To maximise the potential of this study, all variations of pyrolithic technology were examined if the site information could be accessed. This included burnt stone spreads with no identifiable features, including sites that lay outside a particular road or pipeline corridor and could not be fully excavated, and those examples where components of the water-boiling or roasting process were identified. As a consequence, some sites were excluded from the study based on the limited excavation evidence, the absence of excavation records and uncertainty as to whether a true pyrolithic technology was carried out. A number of constraints were also created by rescue environment of most of these burnt mound investigations. Prior to the study, much of this new information remained unpublished due to nature of the large number of developments undertaken by commercial archaeology companies during the so called 'Celtic Tiger era' (1998–2007). Much of the relevant information is available in the excavation reports submitted to the licence authority of the National Monuments Section of the Department of Arts, Heritage and Gaeltacht. Access to this information varied with some excavators only providing permission to consult reports in the Department Offices in Dublin. Although there is a legal requirement that copies of excavation reports should be lodged with the licencing authority, this had not always been done and in many cases these were only preliminary stratigraphic reports. In the Republic of Ireland, access to reports less than three years old is not permitted without written permission from the site director. Such requests were not always met with full co-operation depending on the attitude of individual directors. As a result the full information from a small number of sites could not be included in the study.

Consultation with archaeological companies yielded more success than with individual excavators. This survey was conducted following background research, so that it was possible to approach consultancies for details with lists of their published sites that were relevant for the project. Those consultancies with no record of publication were also approached in order to capture sites that had not yet entered the public domain. It was not possible to establish contact with every commercial company even after several requests were made. The level of detail in these reports also varied considerably, with some consisting of basic stratigraphic information, while others still awaited specialist analysis, radiocarbon dating and final interpretation.

In the event where commercial companies or site directors could not be contacted in relation to burnt mounds excavated on road development projects, many final reports were kindly provided by Transport Infrastructure Ireland (TII). Their online database was also useful in this regard. This contains a basic account and classification of sites excavated by TII, with details of radiocarbon dates and other analyses.

While every effort was made to acquire information on excavated sites, a number had to be excluded where reports were not available or written. This still left 1165 sites with excavation details for analysis in this study. Despite the problems of accessing unpublished site information, and the variable standard of records, enough data was collated to gain a better understanding on the burnt mound phenomenon.

In analysing the data, the formation processes involved in the creation of the archaeological record were carefully considered. In relation to the context of artefacts and radiocarbon samples it is clearly important to assess the possibility of pre- and post-pyrolithic activity on the site. Exploring both cultural (c-transforms) and natural (n-transforms) in the formation of sites is essential to a more comprehensive understanding of the archaeological record (Schiffer 1987: 22). This is explored further in Chapter 5, following a tentative classification of these sites in Chapter 4. It is acknowledged that the available data does not always fit neatly into the parameters constructed. The value of classification, however flawed, is to illustrate the wide variety of situations in which burnt stone deposits

are found and allow distinctions to be drawn between the different types of site employing pyrolithic technology.

Theoretical framework

To understand the use and social significance of burnt mounds, several theoretical approaches are considered. At a most basic level archaeological theory today is generally grouped into two approaches, namely processual and post-processual archaeology. Processual archaeologists believe that cultural change happens in a predictable framework that can be understood and unlocked through the application of science (Trigger 1989). It seems that the functional and economic aspects of processual archaeology have been to the fore in research on burnt mounds in Ireland (Condit 1990; Cooney and Grogan 1994; Gosling 1994). Many of the studies published by Buckley (1990) and Barfield and Hodder (1991) have some theoretical basis (particularly processual approaches) but unfortunately there has been little integrated study of these sites in Britain and Ireland. As Ó Néill has observed, 'burnt mound research in Ireland has revolved around a series of analytical approaches, rather than as a focus of *de facto* explorations of archaeological theory' (2009: 21).

One approach to understanding how community, place and identity were connected to the use of burnt mounds is to consider their landscape context. Although archaeologists have always been interested in the broader environmental context of ancient settlements and monuments, the idea of 'landscape archaeology' as a theoretical approach for understanding the past is a relatively recent phenomenon. As observed by O'Brien, much of the recent research on prehistoric landscapes in Ireland has focused on so-called 'sacred landscapes', 'elite landscapes' and 'landscapes of power' with little research on the 'unexceptional landscapes of everyday living' (2009: 324). As it is these environments where burnt mounds typically occur, it is important to understand how people in the past related to the world in which they lived, and how they invested their surroundings with cultural meaning through various symbolic processes connected to their sense of time and place. Thomas has observed that 'people are knitted into a network of locales with which, through habitual and inconspicuous familiarity they will have formed a kind of communion' (2001: 173). These locales have the characteristic of being places where people lived their lives in what were inherently 'social landscapes' made up of different scales of relationships. Landscape may thus be viewed as '…a network of related places, which have gradually been revealed through peoples habitual activities and interactions, through the closeness and affinity that they have developed for some locations (*ibid.*, 172). Burnt mounds are good examples of such places: environmentally differentiated space where the setting and use of pyrolithic technology contributed to a strong sense of local place and identity. The use of hot stones for cooking was not just a technical process, but also a social one and it was much about the making and reproduction of social relations, individual and group identities, as about the production of food (see Chapter 6). It is through these social contexts that burnt mounds will be considered in the study.

It is probably incorrect, however, to view landscapes where burnt mounds occur as having a single meaning. There is an obvious physical relationship in the sense of the natural environment in which these burnt mound users lived. There is also an economic reality in respect of the resources these places contained for pyrolithic technology (water for boiling, stone for heating and fuel for the hearth). There are also the political aspects of landscapes, with many examples of so-called 'contested' space. For example, it has often been observed in relation to megalithic tombs that by building long-lasting monuments, human groups laid claim to certain resources. The use of specific spaces by individuals and groups who invested their labour over long periods would have contributed to a strong sense of 'ownership', underpinned by close family ties. The concept is also symbolic in the way that a burnt mound was experienced, perceived and imagined by prehistoric people. People in the past lived in landscapes imbued with many meanings and memories. The re-use of pyrolithic locations over many generations must have been a practice imbued with symbolic meaning where groups created their present by reference to a remembered past (sense of place and history of place).

These issues will be considered in this study by examining the significance of burnt mound clusters and the use histories of particular sites. This is particularly relevant to burnt mounds, connected as they may have been with specialised feasting activities. Such places with complex use histories must have been imbued with meaning and this can be demonstrated at some sites by the presence of deliberate deposits. The building of monuments is about memory and provide constant reminders of the past (Bradley 1993). The clustering of burnt mounds in areas of the landscape may have been part of a process attributing significance to particular places, influencing their interpretation by present and future generations. Burnt mounds had an enduring quality and their physical presence as individual sites or clusters was a constant reminder of a human past that can serve the needs of people in the present. Re-visiting a particular site involved reference to the previous use of that place. Conversely, some mounds may themselves be commemorated through the mounding of further waste-firing stone in the same area.

It is obvious that the continued use of places through time draws attention to the historically constituted connections that exist between members of a community. In this way the landscape is a constant reminder of the relationship between the living and the past generations (Thomas 2001: 175). As Richards (1999: 84) observed, 'the past itself becomes a symbolic resource, and an essential component of the ritual impact of place, a dimension of meaning which can be manipulated to legitimise new political or social ideologies'. In this way, the social relationships of

later users of burnt mounds gained part of their validity by reference to common mythical origins. This can be connected to what Barrett (1999: 260) referred to as the 'archaeology of inhabitation', an understanding of place according to certain traditions and conventions, to which people contribute through their own practices.

Settlement space is also invested with cultural meanings that influenced how it was ordered, used and valued (e.g. Hodder 1990; Richards 1990; Parker Pearson and Richards 1994). As outlined by Brück (2001), these perspectives challenge strictly functional interpretations of activity areas. Although this type of analysis is usually applied in a settlement context, the same principles can be adapted to the study of burnt mounds if one accepts their broad association with nearby habitation. Parker Pearson and Richard's study of spatial organisation highlights the importance of considering symbolic meanings when exploring architectural space, and also that different meanings apply in different cultural contexts. Because activity at burnt mounds generally focused around the use of a boiling pit, excavators have highlighted the possibilities that some well-preserved sites provide evidence of a formal organisation of space around a central trough (Toolis 2005). This may be evident from a number of recently excavated burnt mound sites in Ireland, where burnt stone was deliberately deposited away from the central working area or where it was deliberately defined and revetted as opposed to haphazardly dumped in the immediate vicinity. Also relevant is the location of hearths and other stake-built structures almost exclusively at the short end of the troughs (Figure 1.4).

Figure 1.4. Edward Fahy's excavated stone trough and hearth from Drombeg, Co. Cork. Source: Dan Breen, Cork Public Museum.

Of some relevance here is the social analysis of space, approaches that were first developed by Clarke and Fletcher in the late 1970s (Clarke 1977; Fletcher 1977). Caution, however, must be expressed when dealing with social organisation of space as burnt mounds were unenclosed and the partial nature of many site records could hinder such analysis. That said, it is important to explore the cosmology that governed people in the past (see Barrett 1994). The idea that there is more than a functionalist or economic reasoning behind spatial organisation is an approach that can certainly be applied in relation to burnt mounds.

Agency has also been useful in the current thesis as a means to describe the role of the individual in the formation of burnt mounds. 'Agency' refers to the capacity of the individual to act independently out of inclination or self-interest (Giddens 1984). The more complex notion of group agency has also been important and revolves less around the role of conscious choices in affecting the environment, and more around the functioning of traditions and habits held by a group. These traditions are made up of attitudes and decisions made regularly by individuals within the group. Of particular relevance here was the idea of habitus, the way in which an individual's instinctive sense of what might be achieved is structured into a pattern of behaviour and passed on through the generations (Bourdieu 1977; 1990). For instance, burnt mound material found adjacent to the trough was deposited continuously over many years of intermittent use, a process that represents meaningful and intentional human agency (Dobres 2000). One effect of concentrating the debris within a limited area was to increase the height of the mound, with the result that they became strong visible symbols within the landscape.

On the basis that location mattered to the people in the Bronze Age when carrying out pyrolithic technology, it can be suggested that the position of burnt mounds may reveal something of social structures. Place matters, in that a landscape can be seen to be assigned meaning through places, and can be argued to be made up by a series of places (Casey 2008: 44–49), that meant something to the people who live in relation to them. There is no such thing as a 'non-place' as observed by Thomas (2001: 173), as a space is created when meaning is assigned to a specific area or feature in the landscape. These broadly post-processual ideas argue that settlement space in a given landscape was invested with cultural meaning, which influenced how it was ordered, used and valued (e.g. Hodder 1990; Richards 1990; Parker Pearson and Richards 1994). This perspective challenges the strictly functional interpretations of activity areas such as burnt mounds. One way to avoid the continued dislocation of 'functional' activities from discussions of

landscape as a cultural construct is to recognize that human action is always both practical and symbolic. As observed by Brück and Goodman (2001) any practical action may also be symbolic, as it reproduces a set of cultural values and social relations that are embedded in cosmological schemes. These are some of the many considerations for the current study of burnt mounds in Ireland.

1.4 BOOK STRUCTURE

This book is divided into four major sections, with nine chapters and a supporting catalogue (accessed online). The first three chapters are intended to contextualise the study, by presenting the overall research context and introducing the reader to the burnt mound phenomenon in Ireland and other parts of north western Europe (Chapters 1–3). The second section outlines the nature of burnt mound excavations in recent years and presents a detailed analysis of the new excavated material, along with a review of recent radiocarbon evidence (Chapters 4–6). The next section is the final interpretive section of the work, which moves from the detailed analysis of burnt mound features to a broader understanding of chronology, use, and social significance of pyrolithic technology in Ireland (Chapters 7–9). Finally, the last section presents the catalogue of excavated burnt mound sites in Ireland from the period 1950–2010. This can be access online at https://cora.ucc.ie/handle/10468/1953 and represents the authors PhD catalogue. A shorter appendix detailing a list of excavated sites is presented at the end of this book.

The next chapter (2) examines the history of research from early antiquarian investigations to the first scientific excavations during the mid-twentieth century. The value of the early Irish literary sources is also considered, which describe the use of pyrolithic technology and the influence they had on later interpretations. An account of the excavation and sampling strategies employed on infrastructural projects and the many problems associated with the investigations of burnt mounds on these schemes is also discussed. Chapter 3 outlines the international distribution of the burnt mound phenomenon with particular emphasis on the British evidence. A broader discussion based on the use of this technology in other prehistoric cultures in western and northern Europe will also be examined.

Chapter 4 is the first of two chapters that examines the ‘Celtic-Tiger’ era of commercially archaeology in Ireland and the subsequent upsurge in burnt mound discoveries and excavations as a result. This outlines the new archaeological evidence from burnt mound excavations over the last two decades, including such features as troughs, hearths, pits and ancillary features. It will be argued that not all sites share the same morphological characteristics, with the evidence suggesting that other functions are possible. Chapter 5 describes the approaches to dating burnt mounds, both historically and using current applications. The overall chronology will be presented using recent dating evidence that will shed light both on the origins of the tradition and when the use of the technology is abandoned. An assessment of the material culture recovered from these sites also highlights the problems with using these artefacts as reliable dating evidence. The chronological evidence is discussed further in relation to cultural context in Chapter 8.

Chapter 6 is the first of three discussion chapters that examine the results of burnt mound excavations in Ireland (Chapters 6–9). This chapter considers the use and social significance of these sites in light of this evidence. Chapter 7 explores the landscape setting of these sites and their proposed relationship with nearby contemporary settlement. Chapter 8 continues with the theme of chronology and discuss the cultural context of the technology. The use of the technology will be discussed from its earliest beginnings in Neolithic Ireland to its widespread use during the Bronze Age. The abandonment of the open-air tradition of pyrolithic water-boiling will also be considered and it will be argued that the technology did not continue into the historic period. Chapter 9 will draw information from the previous chapters to discuss the conclusions that arise from this study, and to suggest directions for future research.

The main text is supported by a database and catalogue containing a record of some 1100 excavated burnt mound sites in Ireland. Appendix 2 is the principal database and includes a list of all known scientifically excavated sites in Ireland from 1950–2010. This data is presented in a table format giving each site its own unique catalogue number. Basic locational details are also provided, while the main excavated features (troughs, hearths, burnt mounds etc.) are presented along with the dating evidence if available.

A more comprehensive catalogue is available online through the authors PhD thesis. It is presented in this format due to the sheer volume of information collected and as such, could not be included here. It includes a summary of the excavation record providing information such as locational setting, cultural landscape, excavation information, site interpretation and any plates and figures. This is presented in Microsoft Word format in alphabetical order by county, from the earliest excavation to the most recent. The catalogue numbers presented in the main text refer to a unique numbering system given to each site and can be cross-referenced with the catalogue for further information.

Appendix 1 is a collection of tables that, because of their lenght, could not be inlcuded within the main text.

Chapter 2

A history of burnt mound research in Ireland

This chapter examines research and investigation of burnt mound sites in Ireland from the late eighteenth century to the first scientific excavations of the 1950's. It also considers the impact of infrastructure archaeology in the late twentieth century, which drew significant attention to the large number of burnt mounds that survive as levelled sub-surface sites across the island. The chapter begins by considering the value of the early literary sources, which describe the use of similar pyroclastic technology and the influence these references had on later interpretations.

The use of burnt mounds in prehistoric Ireland declined dramatically after *c.*500 BC leaving thousands of visible burnt mounds across the Irish landscape (see Chapter 4). These must have been the subject of much curiosity in later periods when understandings of their significance were clouded by the great passage of time. We know, for instance, that incidental discoveries and speculation about ancient artefacts and monuments occasionally feature in early medieval literature in Ireland (Waddell 2005: 8). The possibility of some early physical investigation inspired by oral tradition about their basic function cannot be discounted (see Chapter 8). Such investigations may have eventually made their way into the later religious and literary texts of the time, which are concerned with laws, genealogies and historical or pseudo-historical narratives (Kelly 2000). Excavation has demonstrated that burnt mounds were often used as dry platforms to carry out activities related to iron working in later periods. Recent excavation has also demonstrated that medieval corn-drying kilns share a spatial relationship with many burnt mounds. This may have led to some interest into the origin of these monuments. Moreover, because 'pot-boilers' were still being used to heat liquids in many medieval urban centres (Edwards 1990: 83; Ó Drisceoil 2011:21), an awareness of the culinary connections to hot stone processes may have led in time to an association with some form of outdoor cooking (Dineen 1908).

2.1 THE EVIDENCE OF EARLY IRISH LITERATURE

Diarmuid Ó Drisceoil reviewed the literary sources as part of a major thesis on burnt mounds (*fulachtaí fia*) completed in 1980 in University College Cork. Although the complete term *fulacht fiadh* does not appear in any early sources, he identified the use of the term '*fulacht*' and references to activities that may have taken place at such sites. The word '*fulacht'* and its derivatives including *'fulacht, fulocht, folucht, Inadh fulacht* (cooking place)', are found in literary sources dating from ninth to the eighteenth century AD, including law tracts, glossaries, Saint's Lives, histories, annals and poetry and written in Old, Middle and early modern Irish (Ó Drisceoil 1988: 1990). He showed that when translated, the word '*fulacht*' originally meant 'recess' or 'cavity' but later came to mean 'cooking place'. '*Fiadh*' can be translated as 'of the deer' or 'of the wild', while fian means 'of a roving band of hunters or warriors' or also 'of the Fianna' or Fionn Mac Cumhail, mythical figures of Irish folklore. The related term *inadh fulachta* (cooking place), occurs in the Agallamh Beg, a 12th-century Irish text, where the following reference is made:

'They made a bothy for themselves that night, and a broiling of food was made by them. And Caoilte and Finnachaidh went down to the stream to wash their hands. 'This is a cooking-place', said Finnachaidh, 'and it is a long time since it was made.' 'That is true,' said Caoilte, ' . . . and it is not to be worked without water' (Hyde 1916: 339–345).

Ó Drisceoil (1990:158) linked the term '*fulacht*' to a cooking tradition but cautioned that even when a cooking place is implied, it does not necessarily have to be a boiling site. He observed that many texts, especially the 'fictional' tales, are amalgams of earlier sources where details have changed over time. The fanciful nature of many of the passages, especially the poetry, casts considerable doubt on the reality and relevance to contemporary conditions of much of the material (Ó Drisceoil 1980: 207). Furthermore, he observes that the term '*fulacht*' could easily be applied to cooking on a spit, in a cauldron or on a griddle, a point highlighted by others (Kelly 2000; Ó Néill 2005). Ó Néill (2005: 84) states that the true origin of the term might derive from words such as folach 'support' or fuil, fola 'blood' and may intentionally contain resonances of both. This illustrates the ambiguity in early Irish literature, whereby certain references to the term are obscure and difficult to translate, possibly to the point where the term '*fulacht fia(dh)*' - in relation to pyrolithic technology - is inappropriate, with a more neutral term such as 'burnt mound' to be proposed.

While early medieval sources can be quite equivocal with regard to the processes involved, the later accounts are rather descriptive and greatly influenced modern interpretations. For instance, references to a boiling practice are considerably late, with the earliest account found in the medieval Latin *Life of St Munnu*, dating from the fifteenth century, as follows: 'they did not sieve the flour, but rather mixed it in a basin with water, chaff and all, and cooked it with fire-heated stones' (Ó Néill 2005:

79). The seventeenth-century text *Foras Feasa ar Éirinn*, written by Geoffrey Keating, is the only source that associates the term '*fulacht*' with heating water by using hot stones:

'...and it was their custom to send their attendants about noon with whatever they had killed in the mornings hunt to an appointed hill...and to kindle ranging fires theron, and put into them a large number of emery stone; and to dig two pits in the yellow clay of the moorland, and put some of the meat on spits to roast before the fire; and to bind another portion of it with sugáns in dry bundles, and to set it to boil in the larger of two pits, and keep plying them with the stones that were in the fire....until they were cooked. And these fires were so large that their sites are today in Ireland burnt to blackness, and these are now called Fulacht Fian by the peasantry' (Dineen 1908: 329).

A passage from an eighteenth-century text, '*The Romance of Mis and Dubh Ruis*' describes a similar boiling practice using hot stones:

'he made a large fire of dead wood from the forest and he gathered up a heap of granite stones, and he put them in the fire. He made a pit, square all round in the ground, and he filled it with water. He cut up his meat and he wrapped it in marsh grass, with a well-turned súgán around it, and he put it in the hole and he was supplying and continuously putting the well reddened, long heated stones in the water' (Ó Cuív 1954: 330).

The later tale is taken from a manuscript written in 1769, but seems to be older by at least a few centuries and does not include the term *fulacht fia*, even though it describes a pyroclastic water-boiling process.

It has been observed that Keating's concern in *Foras Feasa ar Éireann* was not the collation of information but rather the development of an origin myth that suited contemporary political goals (Ó Néill 2005: 81). Waddell (2005: 34) also questions Keating's sources owing to other fanciful creations, such as Druidic rites, which he imagined occurring at megalithic tombs. It seems that much of the material featured in *Foras Feasa ar Éirinn* was derived from earlier sources, 'the old books' (sein leabhraibh) mentioned by Keating, adapted and retold to suit contemporary perceptions and values (Cunningham 2000: 126). As Voss (1987: 81) has stated, 'to understand the folklore of ancient monuments, one has to focus upon the cultural context of the storyteller rather than upon the culture of the monument builders'. In this respect, an examination of the cultural context of these references is an important factor in ascertaining their value for understanding the burnt mound tradition. The past is interpreted in accordance with present habits and preferences; the mystery and imprecision of the past are important because such characteristics allow alternative and flexible explanations that are relevant to present viewpoints and concerns (*ibid.*).

While burnt mound locations were often visited in later periods of prehistory, the activities undertaken at these sites during the medieval period were unquestionably different (see Chapter 9). Although their original significance may have been lost, an awareness of hot-stone technology may have been acquired through later physical encounters with these sites in the landscape. Being the most numerous prehistoric site in Ireland, burnt mounds would have been highly visible, either as individual sites or in close clusters. This would have been even more evident before the intensive agricultural practices of the modern era that resulted in the levelling of many sites. These excavations would have created a certain sense of mystery and intrigue during later periods of history, promoted by earlier oral accounts, creating an opportunity to express tales about past societies through folklore and storytelling. As stated previously, tales like these may have inspired investigations, leading to an understanding of the processes involved. This may explain for certain references where an appreciation of a site's antiquity is evident, such as a passage in the twelfth-century text Agallamh Beg referring to an '*inadh fulachta*' (cooking place) that had 'long since been made' (Ó Drisceoil 1988: 673).

2.2 ANTIQUARIAN INTEREST

Antiquarian studies of all things ancient are quite separate to modern 'scientific' approaches to the past. Most antiquarians of the nineteenth century in Ireland were clergy or professional men with good educational backgrounds who had interests in history, Irish culture and ancient artefacts and monuments. Their investigations of ancient monuments often lacked discipline and any systematic recording. Where elements of the archaeological record could be associated with literary accounts, both became finely intertwined giving the antiquarians a focus for their activity. This is particularly true for early interest in burnt mounds, where the literary tradition heavily influenced interpretations, often leaving little separation between fact and fiction.

The establishment of the Ordnance Survey of Ireland in 1824, and the subsequent mapping of the island, at a scale of six inches to the mile between 1825–42, provided the first systematic mapping of ancient monuments, especially ones which stood out in cultivated land, such as castles, churches, round towers and earthworks (Waddell 2005: 98). Although thousands of burnt mounds were omitted from the first and second edition of these maps, some examples were included, which encouraged some antiquarians to consider the significance of these monuments (e.g. Hackett 1854–88).

Many of the earliest antiquarian reports are from Co. Cork where burnt mounds occur in great numbers. A *Statistical Survey of the County of Cork*, published in 1815 mentions that 'in that part of Ireland heaps of burnt stones are found in great numbers, which are said to have been used by the inhabitants, in ancient times, for cooking their victuals' (Townsend 1815: 101). This probably reflects the

influence of the earlier literary sources, notably Keating's seventeenth-century text, *Foras Feasa ar Éirinn*, which linked this type of cooking with a mythical band of warriors known as the *Fianna*. Townsend also mentions that the stones are commonly small 'seldom exceeding half a pound weight, and when in convenient spots are used for repairing the roads' (1815: 102). This is the earliest reference to the vulnerability of these sites in Ireland. Spreads of 'dark soil and surface stone' are recorded in the Geological Survey mapping of Ireland from the 1860s, suggesting that burnt mounds may have been levelled and visible in the ploughsoil at this early stage (Cleary and Hawkes 2013). John Quinlan (1885: 390) also recognised the destructive process of land reclamation at this time. He observed that 'the great number of these mounds have been broken up and scattered about by plough and harrow'. William Hackett's early fieldwork would identify a similar situation. He writes; 'one field now under green crops is nothing but Folacht, it is fully four acres in extent, but I imagine, this is only caused by the levelling of some huge mounds (Rockley 2000: 286). A statement in Lewis's *Topographical Dictionary* (1837: 265) in relation to Co. Limerick where extant examples are relatively absent is worth noting in this context, 'In many parts of the county old fireplaces of the primitive inhabitants are occasionally turned up, containing burnt earth, charcoal, sooty and siliceous stones'. Because burnt mounds are situated in areas prone to reclamation, large numbers were levelled in modern times and only survive today as spreads of burnt material in plough soil (Figure 2.13). It is interesting that even in the early nineteenth century, burnt mounds were being levelled on such a regular basis that this warranted specific mention by notable antiquarians.

It was the Cork antiquarian William Hackett who seemed to be most informed about these monuments in the mid nineteenth century (Rockley 2000; 2008). The idea that burnt mounds were temporary cooking camps led Hackett to consider similar cooking methods in North America where he deduced that, as both the 'Fenians' and the Indians were hunters, there should be 'a similarity of habits' (Rockley 2000; 280). He would later find more convincing comparisons between Irish burnt mounds and the cooking practices of native New Zealanders (Hackett 1854: 59). His interests led him to carry out a number of excavations where he soon became well versed in the morphology of these sites. He describes in one of his many letters to John Windele how he 'might find an interesting field for investigation in the exploration of some of those ancient heaps of burned stones scattered through the country, known in the county of Cork as *Folach Fia*, in Tipperary as Deer Roasts and in Ulster as Giant Cinders' (*ibid*.:59). He states that he had frequently explored 'heaps of those Giants Cinders and in several instances, by draining out the water, came upon a wooden trough formed in the hollow of a large tree, the use of which manifestly was to boil water in by passing heated stones through it in rapid succession' (*ibid.*). He also refers to different types of water troughs found during these investigations, some formed by 'boards and trenails', others made of marl 'brought to hardness equal to stone'. The average dimensions of the troughs excavated by him were given as 'six feet long, two feet broad, and one foot three quarters deep, except the hollowed trees, which are sometimes longer and narrower'.

Although highly influenced by the narratives of Geoffrey Keating, Hackett began to question the idea that they had been constructed by the Fianna, who he considered were unlikely to 'have raised the one thousandth of these'. Townsend, writing earlier in the century may have been equally perplexed by their density as he states that burnt mounds were so numerous that one could 'infer a very considerable degree of early population' (1815: 145–6). Hackett felt that the term '*fulacht fiadh*', which he translated into English as 'deer roast', had been incorrectly translated by others due to the addition of 'fian'. This gave way to the erroneous idea, in his opinion, that they were associated with a band of warriors or hunters as suggested by Keating (Rockley 2000: 281). He was also of the opinion that burnt mounds occurred nationally but he suspected that the sites were more 'rare in limestone districts than elsewhere, as the stones fit for the heating process should be such as would not be likely to crumble into lime, or to vitrify' (Hackett 1854: 60–1). His views regarding the density of these sites would later prove to be correct, with burnt mounds now considered as Irelands most numerous prehistoric monument. In addition, his cautionary note on the use of limestone for boiling would also prove to be correct during later experiments.

A contemporary of William Hackett, Thomas Carew Hunt, often accompanied him on fieldwork and both

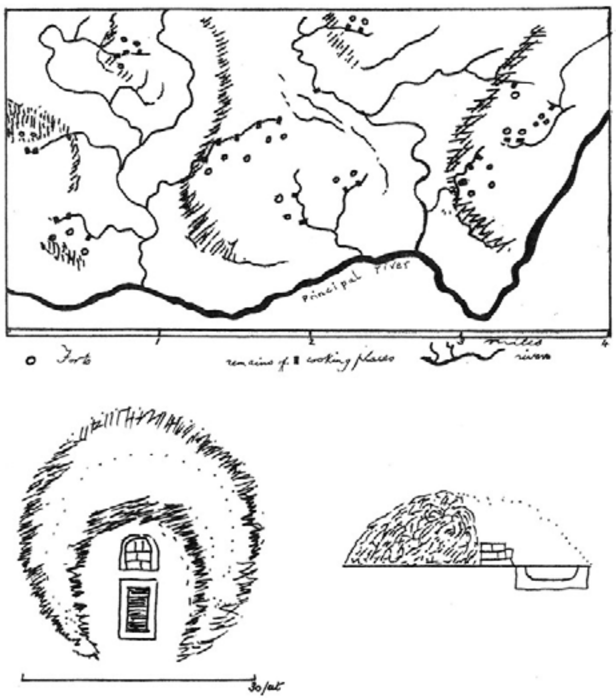

Figure 2.1. Map compiled by Thomas Carew Hunt *c.* 1843 (top), along with sketch of burnt mound (bottom). source: Rockley 2008

became convinced that burnt mounds were found close to the water source that also served a ringfort (Figure 2.1). Hunt's theory was later discounted by John Windele who argued that burnt mounds 'belonged to an aboriginal race who preceded the fort builders' (Rockley 2000: 282). Although Hackett would later concede that ringforts had no direct relationship with these sites, he did correctly note the proximity of burnt mounds to water. His familiarity with these monuments allowed him to identify a number of burnt mound troughs that were mistakenly interpreted as 'boats', one of which at Coolowen, Co. Cork had similar workmanship to the more ancient troughs (*ibid*.: 282). The antiquarian, William Wakeman, published an article in 1872 that describes the discovery of another hollowed out oak tree. The author described it as a canoe, however it seems more likely to have been used for another purpose as the bottom of the "vessel" is square in nature and thus could not have been used as a boat (Wakeman 1872: 16).

Although Hackett carried out a number of early burnt mound excavations, there are few details known about the site in question. The earliest recorded investigation of a possible burnt mound was in 1849 at Killyon Church, Co. Kilkenny (Cooke 1849–51). There is a record of a pit 'of about ten feet diameter and two and a half feet deep, having its bottom and sides lined with granite rocks'. The source goes on to describe the ground around the pit covered with rocks 'exhibiting marks of having been exposed to intense heat…..with considerable quantity of charcoal mixed with ashes all around' (Cook 1849–51: 216). The author connected these features with the cooking method described in the seventeenth-century text *Foras Feasa ar Éirinn.*

Coleman (1893: 262–3) describes an investigation of a burnt mound in 1853 at Carrigclina, near Mallow by the South Munster Antiquarian Society which included John Windele, William Hackett, Richard Brash and Rev. R. Smiddy. Surmised by Father Smiddy in the Cork Examiner, the expedition was led by John Windele. He describes a large wooden trough;

'*...composed of planks, eight in number, four of which formed the sides and ends and four the bottom. Its dimensions were six feet long, four wide and two deep and the workmanship such as might have been effected with stone-axes, with no nails of any kind. A rude groove at each end of both sides received the cross planks which formed the ends, and through the middle of the bottom, a rough wooden bar, somewhat rounded, penetrated into the marl beneath. The outside of the planks were nearly as rough as when felled from their native oak-forest'* (*ibid.*).

The landowner informed them that;

'*in his youth the burnt stones were not on the surface at all, as now, and that the place was covered by a turf bog, more than four feet deep, but that from time to time this was cut and carted away for fuel, 'til in this way the burnt stones first made their appearance'* (*ibid.*).

A few years later, two possible burnt mounds in the Cork region were investigated by one of the most notable antiquarian figures of the mid-nineteenth century, Lieutenant-General Augustus Pit-Rivers (born Henry Lane Fox). Pitt-Rivers began his archaeological career in Co. Cork when he was stationed as Assistant Quarter-Master General between 1862–1866. A number of excavations were carried out by Pitt-Rivers and Dr. Richard Caulfield in the 1860s, two of which included probable burnt mounds situated east of Lisnaraha, Co. Cork (Shee-Twohig 1987: 43). Caulfield describes the investigation of 'two tumuli situated 21 paces apart' in the June 1865 edition of the *Gentleman's Magazine*. He states that 'these were excavated to a depth of 6′ and the entire substratum was composed of burned stones and pieces of charcoal' (Caulfield 1865: 707). Caulfield seems to be aware of the association with these sites and cooking and subsequently compared the Irish method with an American Indian practice, 'cooking by heating a quantity of stones, and placing them upon the flesh or fish till half baked' (*ibid*.).

While burnt mounds in Cork received a considerable amount of scholarly attention during this period, much of this information had gone unnoticed. For instance, in 1895, C.G Fairholme describes a curious mound which he opened. 'We cut a deep trench right across it, and found it to be nothing but broken sandstone and charcoal....nobody seems to know what it was'. He goes on to state that his 'mother thinks they smelted iron here' (Fairholme 1895: 230). Similarly, Smiddy (1873: 52) mentions that 'the name *folach fiadh* is well known to the country people, and they bestow it on a heap of burnt stones, of which, as a rule, they know neither the origin nor the use'. In 1893, Wynne was in search of ancient dwellings in the sandhills of west Kerry, where he noticed;

'*in most of the valleys certain spots had a blackened appearance, exhibiting carbon mixed with limpet shells and broken pebbles....At first I was perplexed by their great abundance and by the fact that all were scorched looking and all were broken. But all doubt of their meaning was gone when I remembered how primitive nations boiled water by heating stones red hot and dropping them into water'* (Wynne 1893: 79).

While some native populations may have been less familiar with the function of these sites, folk knowledge seems to have been well established. Hackett even suggests that burnt mounds had placename associations in some parts of the country. For instance, he states that 'the names of places, such as Garryduff, Ballyduff, Gloghduff, originated in the cinder era....if you ask a countryman why is Garryduff so called, he will answer- yerra then, I don't know if it isn't by reason of the folach fia that's all over it'(Hackett 1854: 61). The 'duff' refers to 'dubh', meaning black, which may equate to the blackened earth of levelled burnt mounds. Interestingly, Ryan (1967: 219) referred to 23 burnt mounds in the parish of Killinaboy, Co. Clare. He mentions an example near the 'Druids Rock' on the northern shore of a lake in Poulnalour, which the

Ordnance Survey recorded as 'Lough Avalla, but this is spelled Lough a Fulla by the natives....this would seem to be translatable as the lake of the two cooking-places'.

Gradually over the course of the twentieth century, research on burnt mounds became more scientific, with field survey, helped by the third edition revision of the six-inch Ordnance Survey that recorded additional numerous examples of these sites. The translation of Keating's *Foras Feasa ar Éirinn* in 1908 led to further interest in these sites. John Quinlan was the first to assign a possible date to these sites, in relation to a mound he excavated in November 1885 in Co. Waterford. He described it as 'hemispherical in form and having an opening towards the stream....this mound is generally covered with stunted crop of Irish furze, and is composed of broken and burned free stone- some pieces being about the size of a goose-egg, others somewhat larger, however undoubtedly broken by man and subjected to an intense heat' (Quinlan 1885: 390). This site seems to have had a hollowed tree trunk with an adjacent stone-lined hearth (Figure 2.2). He refers to these types as being 'in their more perfect state and they present in shape the appearance of a horse foot with the shoe on' (*ibid.*: 390).

Quinlan's excavation would be regularly cited by later investigators including Gordon W. Forsayeth (1913), in connection with a burnt mound he excavated at Ballygambon near Whitechurch, Co. Waterford (Figure 2.3). Forsayeth was the first to comment on the absence of bone at these sites and remarked that it was 'peculiar, if they are really cooking places' (Forsayeth 1913: 178). During his own investigations at Ballygambon and Cool townlands, the only significant discovery described by him was a 'rude stone platform', which he compared to the large stone hearth at Clonkerdon. Interestingly, he mentioned other excavated burnt mounds where only 'burnt stone and earth' are found and states that 'from these circumstances, I am inclined to doubt the truth of the statement that these mounds are cooking-places'. Alternatively, he suggests that these places correspond to Turkish baths and supports this by reference to Wood-Martin's book where Lewis and Clarke, in their V*oyage up the Missouri*, came upon a square hollow '6 or 8 feet deep, formed in the river bank by damming up with mud the other three sides, and covering the whole completely, except an aperture about 2 feet wide at the top' (*ibid.:* 179). In 1885, Gabriel Redmond states that 'it is known that they used "heath" as hops, and these mounds, being situated in the midst of heath, we may infer that some of them, at least, were used as brewing places' (Redmond 1885: 404). Redmond also supports this statement by adding that 'a gentleman told him that a fulacht was opened in Ardmore some time ago and when the vat or coffin was exposed, a quantity of heath was found lying in situ in it, flattened and compressed' (*ibid*.). This 'heath' described by Redmond possibly relates to layers of moss found in many excavated troughs, and believed to have been used to filter incoming water (see Chapter 5).

The early burnt mound research in Ireland was summarised by Macalister (1928) where he describes these sites as 'open-air hearths, usually in the neighbourhood of running water. These are pits, containing ashes, heating-stones, flint flakes, scraps of pottery, slight midden deposits, and, occasionally, relics of wooden vessels and the like'

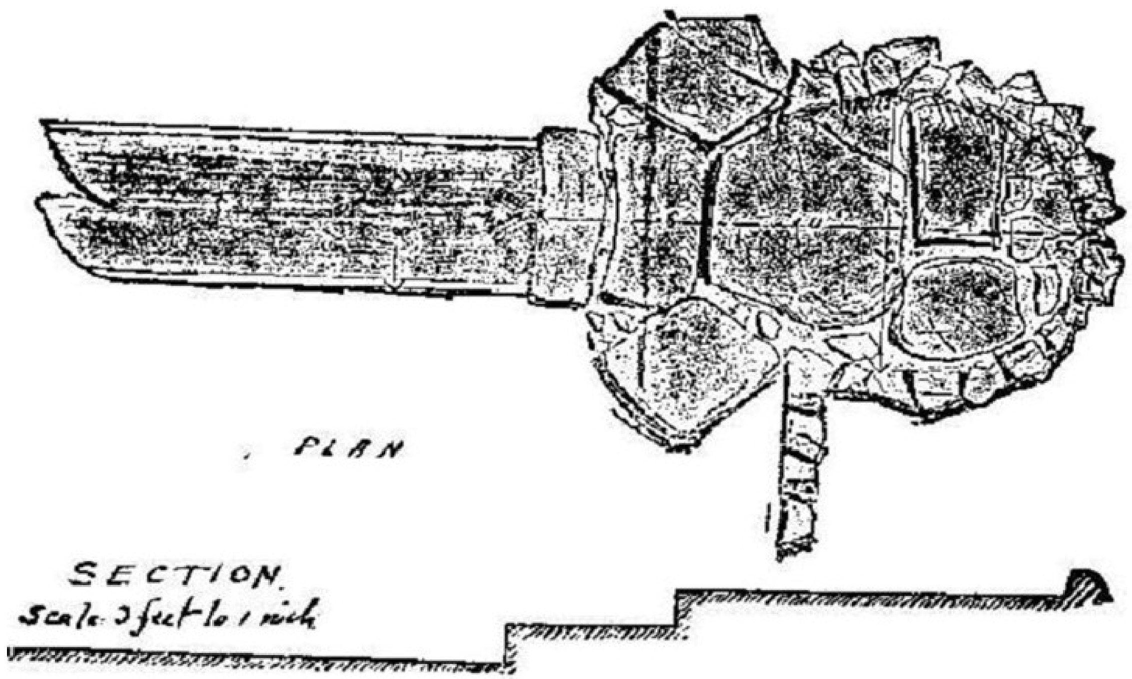

Figure 2.2. Plan of stone-lined hearth and 'dug-out' trough at Clonkerdon Co. Waterford. Source: Quinlan 1885.

(*ibid*.). This description by Macalister reflects the earlier antiquarian investigations and interpretations, but also makes mention of the artefactual evidence. Animal bone was first recorded at a burnt mound by Ó Ríordáin (1937: 57), under more controlled methods of excavation. This site was discovered at Kilnaglery near Carrigaline, Co. Cork during agricultural works and it was one of the first 'rescue' excavations of its kind. Ó Ríordáin identified a levelled mound of heat-shattered stone, a stone hearth structure and a trough pit, which could not be fully excavated as consistent waterlogging made the investigation of the pit very difficult (Figure 2.4). Other early fieldwork carried out by University College Cork includes a study of field monuments by Bowman (1934) and Hartnett (1939) where a great number of burnt mounds in Co. Cork were recorded. Few investigations of burnt mounds are recorded between 1915 and 1950, other than the Kilnagleary excavation by Ó Ríordáin in 1937, with only brief mentions in general publications (Ó Ríordáin 1942; Raftery 1951).

2.3 APPROACHES DURING THE MID-TO-LATE TWENTIETH CENTURY

Although more scientific methods of excavation were introduced into Ireland by the Harvard Archaeological Expedition (1932−6), it was another twenty years before these techniques were applied to the study of burnt mounds. In 1952−3, the then professor of archaeology at University College Cork, Michael J. O'Kelly conducted the first scientific excavations of burnt mounds at Ballyvourney and Killeens, Co. Cork. The latter site is particularly important, as it provided the first radiocarbon date for any archaeological monument in Ireland, famously obtained through the assistance of the President of Ireland, Eamonn

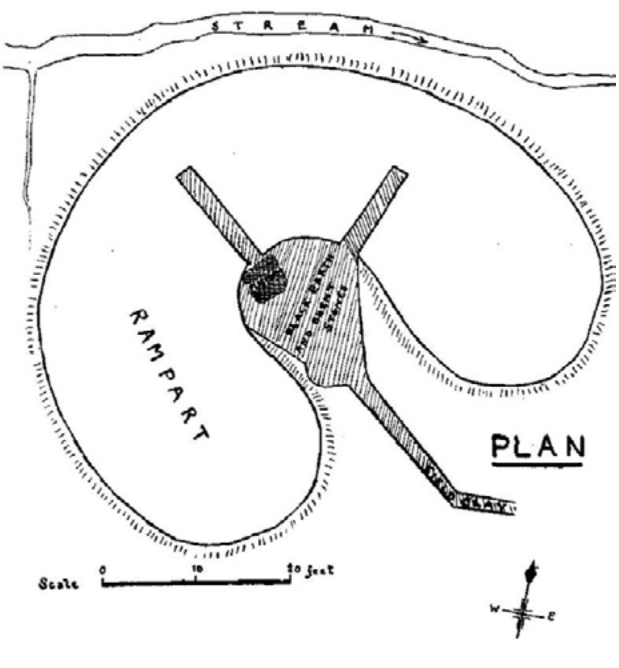

Figure 2.3. Plan of sections through burnt mound at Ballygambon, Whitechurch, Co. Waterford. Source: Forsayeth 1913.

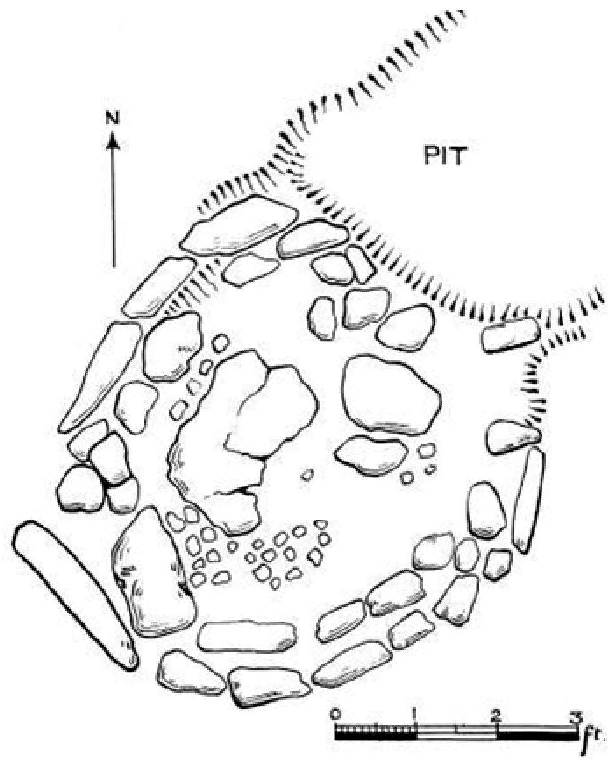

Figure 2.4. Stone-lined hearth and trough pit at Kilnaglery Co. Cork. Source: Ó Ríordáin 1937.

de Valera, who sent the Killeens sample to Chicago through diplomatic channels . These oak samples, from the troughs at Killeens Site I and II were dated to 3506±230 BP (C-877) and 3713±270 BP (C-878) respectively. This provided the first clear indication of the use of these sites in the Bronze Age. The site at Ballyvourney was the more elaborate of the two sites investigated. Through the careful examination of the stratigraphic sequence, O'Kelly identified several use phases. Several phases of trough use were also recorded at Killeens II (O'Kelly 1954). Both sites produced the first indication of built structures, in the form of stake-hole arrangements, indicative of huts (Figure 2.6). However, it was O'Kelly's reconstructions and experiments at Ballyvourney that which would influence the way these sites would be interpreted in later years. He demonstrated that a 4.5kg leg of mutton wrapped in straw could be cooked in three hours and forty minutes using the boiling method (Figure 2.5). After the meat was cooked, the burnt stones were removed from the trough and dumped on three sides of the hearth and trough, giving rise to the characteristic 'horseshoe' mound visible today (O'Kelly 1954:115).

Several other burnt mound excavations were subsequently undertaken in other parts of Ireland as a result of O'Kelly's work in Co. Cork. In the north of Ireland, Hodges (1955) excavated a group of sites at Ballycroghan in Co. Down, one of which produced a timber trough with an internal division and possible associated structural evidence. Prendergast (1955) excavated two sites at Webbsborough and Muckalee in Co. Kilkenny, where two spherical clay

Figure 2.5. The first cooking experiment carried out by M. J. O'Kelly at Ballyvourney, Co. Cork. Source: O'Kelly 1954. (A) Meat is wrapped in straw and placed into the trough, taking 35 minutes to bring 454 litres of water to boil. (B) It is allowed to cook for 3.5 hours after which time the meat is removed (C) and prepared for serving (D).

objects were recovered from the base of a trough in the former site. With no radiocarbon dates, the excavator drew parallels with similar objects found at Newgrange passage tomb, which is dated to the Middle Neolithic period.

Interest in burnt mounds would continue in Co. Cork with the rescue excavation of a burnt mound at Mashanaglass, investigated as part of the development of the Lee Valley Hydro-Electric Scheme of 1952–57 (Fahy 1957). Some years later Fahy (1960) would excavate a substantial burnt mound and hut site at Drombeg in the Glandore area of West Cork. This site provided a second set of radiocarbon dates from a burnt mound site in Ireland, and would become very influential in site interpretations for several reasons. While the samples produced erroneous radiocarbon dates that would be later rectified (Brindley *et al*. 1989–1990), the Drombeg excavations revealed a complex arrangement of features and the first example of a stone-lined trough, complete with substantial stone revetment, well and overflow outlet, in a burnt mound connected via a path to adjacent hut sites (Figure 4.7). The fact that both features are found in close proximity to a Bronze Age stone circle is significant in respect of the possible use of burnt mounds for ceremonial feasting.

The development of mechanised farming along with the building of new roads in the 1960s and 1970s let to the levelling of many burnt mounds in Ireland (Power 2000: 202). This is attested to by the discovery of many such destroyed sites during recent, 'Celtic Tiger' era road and pipeline construction. Such impacts led to the first rescue excavations of burnt mound in Ireland from the 1970s onwards. Early examples include those investigations at Dromkeen East and Rathmore in Co. Kerry (Twohig 1977; Ryan 1976), Ballyhimmin in Co. Kilkenny (Prendergast 1977) and a number of mounds investigated by Michael Ryan (1990) at Catstown, near Hugginstown in 1974. The 1980's saw continued rescue excavation of burnt mounds e.g. Buckley 1985; Cleary 1986; Hurley 1987; Lehane 1988), which ultimately led to a growing interest into the

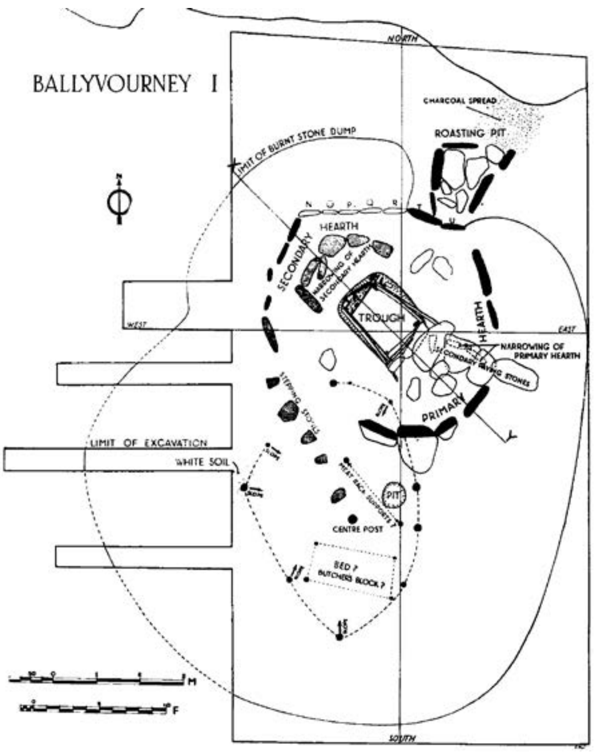

Figure 2.6. Plan of features uncovered at Ballyvourney I, Co. Cork. Source: O'Kelly 1954.

origins and function of these sites. Ó Drisceoil's study in 1980 was the most comprehensive review of burnt mounds at the time, examining all the available evidence at the time along with a re-examination of the early literary sources.

Research into burnt mounds was also growing in Britain (Chapter 3), with various projects in Scotland (Hedges 1977) and in the English Midlands (Barfield and Hodder 1981; 1987). Hedge's analysis of burnt mounds in Orkney found that the mounds were too large, too permanent in character and too numerous to be interpreted as with hunting 'kill' sites. Barfield and Hodder (1987) suggested these sites may have functioned as primitive saunas instead of cooking sites, highlighting the absence of animal bone in these sites, even where soil preservation was conducive. Ó Drisceoil (1988) would later refute this theory based on the excavation evidence in Ireland and the presence of animal bone in his own excavations at Fahee South, Co. Clare. He argued that boiling the water in a trough for cooking was the primary function of these sites, and that bathing was secondary (Ó Drisceoil 1988: 679). This debate would ultimately lead to the formation of the *International Burnt Mound Study Group*, which published two conference proceedings in the early 1990's (Buckley 1990; Barfield 1991). The occasion of the *International Burnt Mound Study Group* in Dublin in 1988 provided both stimulus and forum for a review of burnt mounds and an opportunity to demonstrate parallels between Irish examples and the use of pyrolithic technology in north-west Europe (Barber and Russell-White 1990: 59). The upsurge in economic development in Ireland during the 1990's let to further archaeological excavations, with the result that by the end of the decade, some 150 burnt mound and related sites had been excavated. The early infrastructural projects were the first to alert archaeologists to the large number of burnt mounds that survive as levelled sub-surface sites.

2.4 Burnt mounds and infrastructure archaeology

Commercial archaeology can be defined as archaeological interventions (survey, excavation etc) carried out in areas or locations of historical interest that are impacted by modern developments of various kinds. The Lee Valley Hydro-Electric Scheme in Co. Cork, of the 1950s was the first to consider the importance of known archaeological sites prior to such large-scale developments. This project only considered recorded archaeological monuments with a clear surface visibility. The burnt mound excavated along this scheme at Mashanaglass townland was the first of it's kind to be excavated in such circumstances. Excavation revealed a mound of heat-shattered stone, a formal hearth and a trough pit with four stake holes at each corner which presumably held a wooden lining in place (Fahy 1957:71–3; Figure 2.7).

It was not until the construction of the Cork/Dublin Gas Pipeline in 1981–82 (Cleary *et al.* 1987) that archaeology was considered an intrinsic part of modern infrastructure developments, where the potential for unearthing previously unknown archaeological sites was first recognised. It was also the first major linear project to encounter burnt mounds in such quantities. The gas pipeline was guided by the statutory obligation of the Gas Act (1976) 'to prevent injury to (sites of) historical and archaeological interest' and by National Monuments legislation. Some

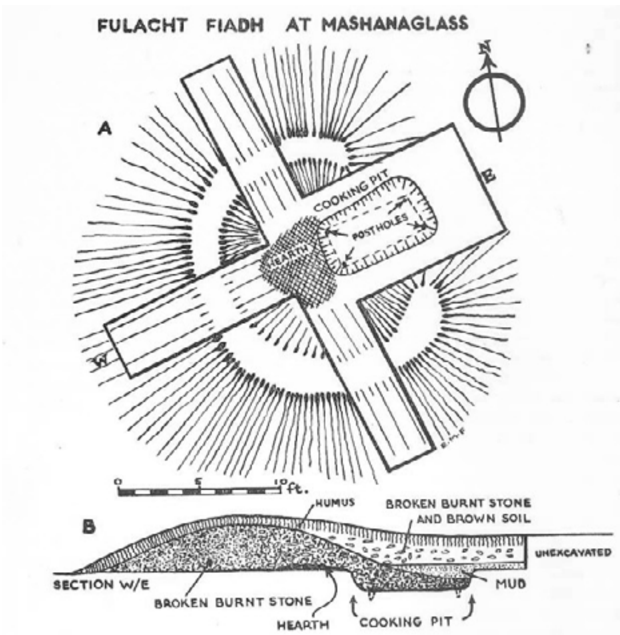

Figure 2.7. Plan and section of features identified at Mashanaglass, Co. Cork. Source: Fahy 1957.

Figure 2.8. Excavation of a burnt mound at Castleredmond, Co. Cork (Cork to Dublin gas pipeline 1982). Source: William O'Brien, UCC.

Figure 2.9. Excavation of a burnt mound at Kilcor South, Co. Cork (Cork to Dublin gas pipeline 1982). Source: Maurice F. Hurley.

29 burnt mounds/spreads were recorded during work on the pipeline, three of which were excavated (Doody 1987; Hurley 1987b; O'Flaherty 1987; Figure 2.8; Figure 2.9). Three further gas pipeline projects were undertaken in 1986 between Mitchelstown to Limerick, Bruff to Mallow and Droheda to Dundalk (Gowen 1988). An additional 42 previously unrecorded, burnt mounds were recorded as a result of these projects, six of which were excavated at the construction phase (*ibid*). A further 35 sites were revealed along the Drogheda to Dundalk gas pipeline, however these remain unpublished (Ó Néill 2009: 21).

The discoveries made along this and other gas pipeline projects in the 1980s revolutionised the perception of the archaeological potential of rural landscapes in Ireland. While pre-construction surveys and site inspections led to the discovery of a number of sites, the true significance of the sub-surface archaeology was not appreciated until the monitoring stage of topsoil stripping where a large number of previously unknown and unrecorded sites were discovered. By the late 1990's, infrastructural projects, particularly road schemes, were rapidly on the increase leaving sites and monuments under sustained development pressure (Cooney *et al.* 2000). There were few archaeological companies in existence, while rescue work was largely carried out by universities and the State (O'Rourke 2005).

In 2000, the Minister for Arts, Heritage, Gaeltacht and the Islands agreed a Code of Practice for archaeology with the Transport Infrastructure Ireland (TII). The objective was to establish a clear and consistent approach to the management of the archaeological aspects of the national road schemes. This agreement led to the employment of project archaeologists by the TII to oversee such road projects) and assess the archaeological implications during route selection. The TII agreed to avoid extant monuments where at all possible, and to preserve by record all known sites being removed by construction works and any other site of an agreed importance uncovered during construction works. Prior to this code of practice there were no advanced archaeological works or specialised contract monitoring undertaken before major road development. Archaeologists were employed to monitor earth-moving machinery and to excavate sites found during the road construction process (O'Rourke 2005: 2). The discovery of new sites at such a late stage did have cost implications for the construction phase of a road scheme and for the time allocated for resolution of the archaeological heritage (O'Rourke 2003: 22). While the State's policy of avoidance of known archaeological sites was acknowledged and enforced, there was little or no appreciation of the wider archaeological landscape during the planning stages (O'Rourke 2006: 1).

The planning process in relation to infrastructural archaeology is now divided into three stages. These guidelines have ensured that archaeology has become part of the planning process, with the developer being responsible for funding any necessary work. The construction of gas pipelines in Ireland is still guided by the Gas Act of 1976 which, facilitated by Bord Gáis, prevents 'injury' to archaeological sites. Pipe-laying is preceded by an initial archaeological assessment of the proposed corridor to avoid known archaeological sites. This includes a desk-top study, field inspection and where applicable, geophysical survey and/or archaeological test excavation (K. Cleary 2015: 2). Archaeological monitoring is undertaken during topsoil stripping of all gas pipeline corridors. Where potential archaeology is detected, it is fully excavated and recorded before pipe-laying is undertaken. Similar codes of practice are now established between the state and a number of other organisations such as Bord na Móna, Eirgrid, Irish Rail and the Irish Concrete Federation.

In light of these major developer-funded projects, a number of significant issues can now be recognised in relation to burnt mound archaeology. Firstly, the distribution of burnt mounds has changed significantly in recent years, demonstrating that previous estimates were greatly underestimated. For instance, between 1992−2009 Irish road infrastructure accounted for 2,300 previously unknown archaeological sites, 92% were newly discovered during archaeological test-trenching in advance of development (McCarthy 2010: 41). The majority of these new sites were identified as burnt mounds (35%) or related pyrolithic deposits such as burnt stone spreads or pits containing similar material. Secondly, new light has been shed on the chronology of these sites and the water-boiling technology. Thirdly, new perceptions associated with the function and social use of the technology can be considered along with the recognition of new features and new prehistoric monument types. This form of large-scale landscape excavation also indicates that many burnt mounds are probably located a short distance from contemporary residential sites. This can be demonstrated at a number of sites in this study (see Chapter 8).

2.5 BURNT MOUND DISCOVERIES: STATISTICS AND DISTRIBUTION

As mentioned above, there has been a significant increase in the discovery and excavation of burnt mounds over the last two decades. Prior to the emergence of developer-funded archaeology, some 137 examples had been excavated in Ireland. Most of these investigations were carried out in the mid-to-late 1990s when burnt mounds were increasingly found during small-scale road building projects. At that time, there were also many parts of Ireland, such as Monaghan, Offaly, Armagh, Carlow, Derry and Westmeath, where known burnt mounds were recorded but which had not been scientifically excavated. In contrast to the many research excavations undertaken in the 1950s (O'Kelly 1954; Prendergast 1955; Hodges 1956; Fahy 1960), most investigations of the 1970s and 80s were carried out under rescue conditions. That period saw widespread land reclamation across Ireland, supported by EU agricultural grants. This resulted in drainage works and the removal of hedgerows, that in turn, led to the destruction of many burnt mounds (Carey and Lynch

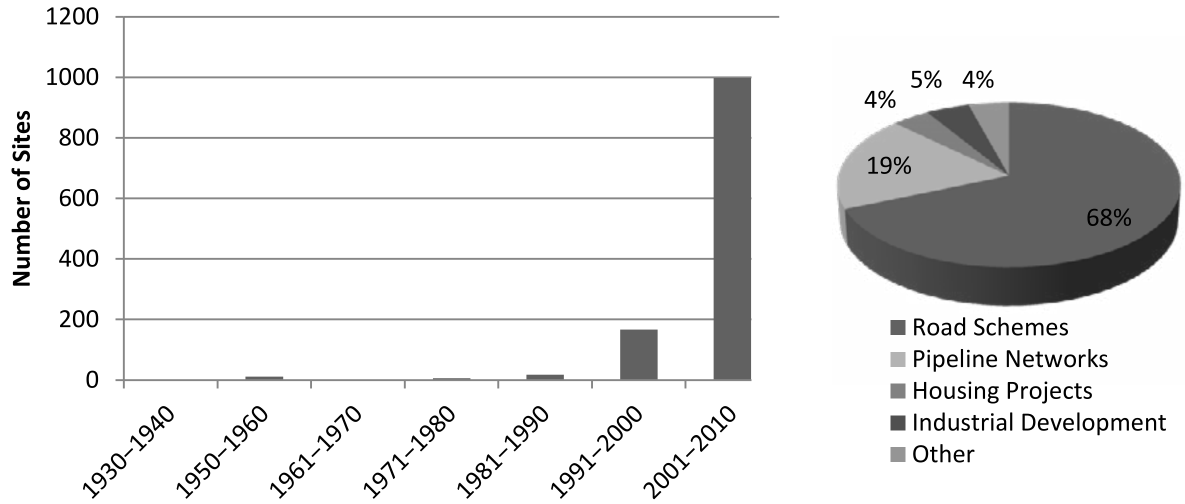

Figure 2.10. Frequency and range of burnt mound excavations in Ireland, 1930–2010.

2011: 106). These developments led to rescue excavations being undertaken at many sites, such as Dromnea, Co. Cork (CO13), Clashroe, Meelin Co. Cork (CO14), Rathmore, Co. Kerry (KY02), Catstown, Co. Kilkenny (KK01), Lyracrumpane, Co. Kerry and Curraghtrasna, Co. Tipperary. Most of these were rapid sample excavations, which focused on the trough and associated features.

The situation would change significantly during the late 1990s with the expansion and extension of many national road networks, and the establishment of the National Roads Authority in 2000 to oversee archaeological investigations. Many burnt mounds were excavated in the decade that followed, usually in a comprehensive manner. By 2010, 1165 examples have been excavated, *c.*900 (68%) of these as a direct consequence of road development, making it the most frequent site type found in such projects (Figure 2.10; Figure 2.11). Pipeline projects connected to gas, water and sewerage networks account for 19% of excavated sites, while developments associated with private housing, industry or mining/quarrying make up the remainder. The majority consist predominately of thin spreads or low truncated mounds of burnt stone and charcoal overlying and adjacent to the remains of troughs and other features in various states of preparation.

The number of sites recovered from road schemes and pipeline development can be seen in Figure 2.14, where burnt mounds account for the majority of identified site-types, most of which were unrecorded and levelled prior to commencement of the road or other developments. It can be assumed that these recorded burnt mounds account for a small proportion of the true number, implying that the current estimate of *c.*7000 is only a rough estimate of their distribution across Ireland. This will undoubtedly change as further large-scale development such as road-building takes place in the future. At the present time, distribution maps are problematic given the vulnerability of burnt mound sites in the landscape. 99% of sites identified during road and pipeline development between 2000–2010 were levelled, unrecorded and showed no surface features prior to investigation. Rare cases of extant examples were uncovered during road development at Caherweelder, Co. Galway (GY 28); Doughiska, Co. Galway (GY01 and GY14); Ballyglass West, Co. Mayo (MO41); Rathwilladoon, Co. Clare (CE56); Cahiracalla Beg, Co. Clare (CE38) and Caltragh, Co. Sligo (SO06). These had been overlooked during the environmental assessment stage or were regarded as of low significance in terms of route selection.

Early accounts attest to burnt mounds being quite numerous across Ireland (Townsend 1815; Hackett 1854), with particular densities noted in Cork, parts of North Munster and Fermanagh. This reflects intensive field survey carried out over the last century, along with a greater appreciation of the site type (Power 1990; Condit 1990; Feehan 1991; Buckley and Lawless 1987; Grogan 2005; Cowley 2011). During the 1980s, the Cork Archaeological Survey (Power 1990) recorded 2,500 sites in Co. Cork with a density of 1 per 3.7 sq. km (Buckley 1991: 3). County Galway has a low density, with just 0.01 sites per square kilometre, however recent GIS analysis undetaken along the route and surrounding area of the N18 Oranmore to Gort road scheme suggested that 73% had one or more neighbour (s) within 1km (Delaney *et al.* 2011: 38). Extant burnt mounds also tend to cluster with groups of up to six or more being recorded, sometimes within a few metres of each other (Power 1990; Waddell 2000; Grogan 2005). GIS trend analysis from recent excavations supports this assessment with particular groupings noted along certain road developments, such as at Sonnagh, Co. Mayo (N25 Charlestown Bypass), Kilbeg, Co. Westmeath (Kinnegad to Athlone road scheme), Cloondarone, Co. Galway (M17/M18 Gort to Tuam motorway), Caheraphuca, Co. Clare (N18 Gort to Crusheen road scheme) and Ballyclogh, Co. Wicklow (Rathnew to Arklow road development) (see Chapter 5 for further discussion on clustering).

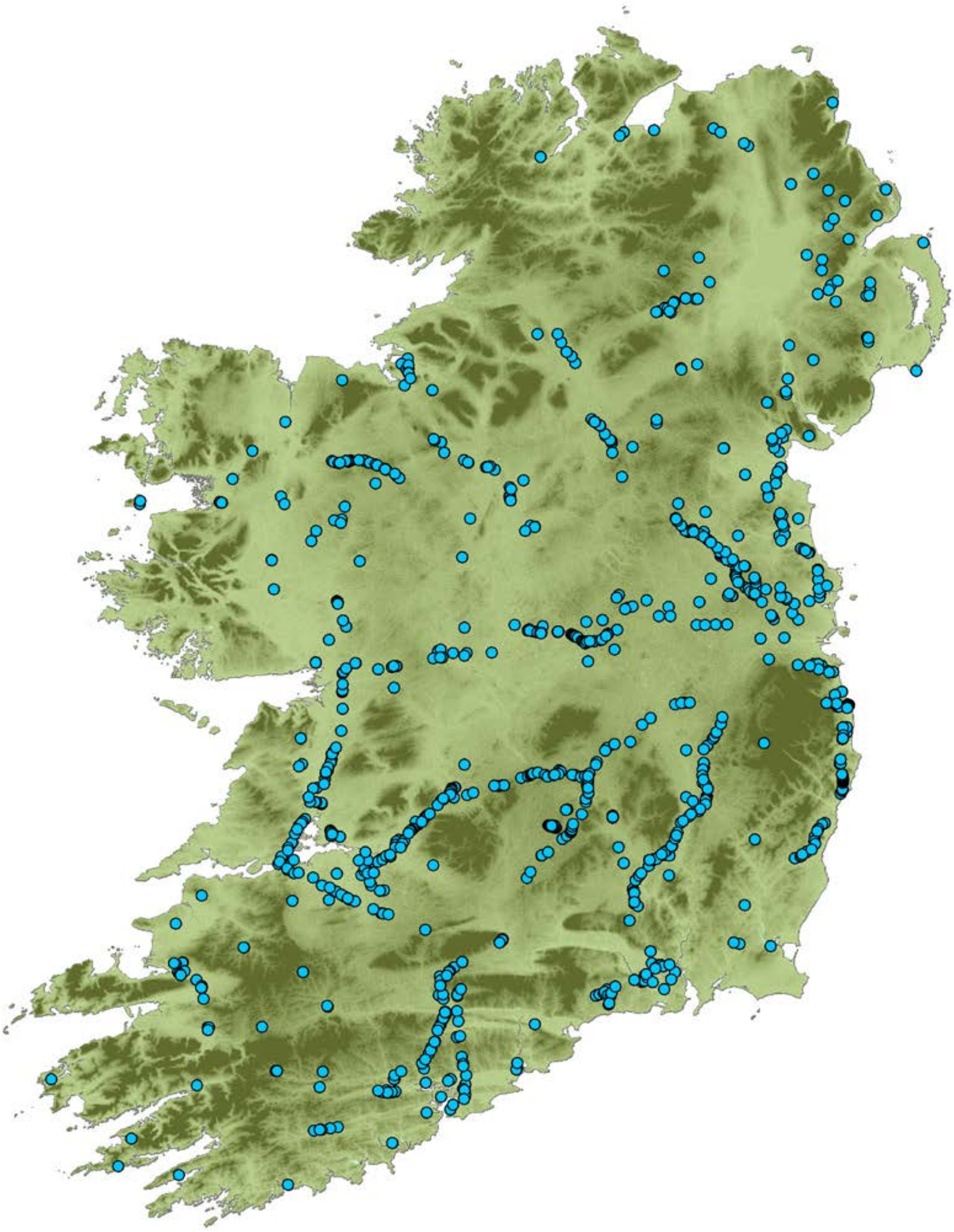

Figure 2.11. Distribution of excavated burnt mounds in Ireland 1950 – 2010. Note linear trends from major road-building projects.

To date, burnt mounds have been recognised in every county in Ireland. This was not always the case with notable absences in counties such as Roscommon, Cavan, Leitrim, Longford and Dublin as late as the 1980s. Moore observed (2003) that counties such as Leitrim are under permanent pasture or bog, and so it is not surprising than burnt mounds have gone unrecorded in such areas. For example, by the early 1990s only three sites were recorded in the Mooghaun area of south Clare (Kirwin 1992). Subsequent investigations identified 76 sites with a density of 0.2 per square kilometre (Grogan 2005: 39). Similarly, in the mid 1980's, only two burnt mounds were known from Co. Mayo, however intensive survey led to the identification of hundreds more by 1991 (Buckley and Lawless 1987: 33). Nationally, the picture has changed significantly, particularly in the last decade with pyrolithic sites now recorded and excavated in every county. The numbers continue to be in Cork, Tipperary, Meath, Wicklow and Mayo, as a direct consequence of large-scale infrastructural development. Where the numbers of known excavated sites are small, such as some of the northern counties, this is a reflection of limited road development or problems with accessing excavated material.

Figure 2.12. Denuded burnt mound at Croaghaun, Co. Clare (unrecorded). Source: Alan Hawkes

Figure 2.13. Levelled burnt mound at Moneygurney, Co. Cork (SMR CO086-133). Source: Alan Hawkes

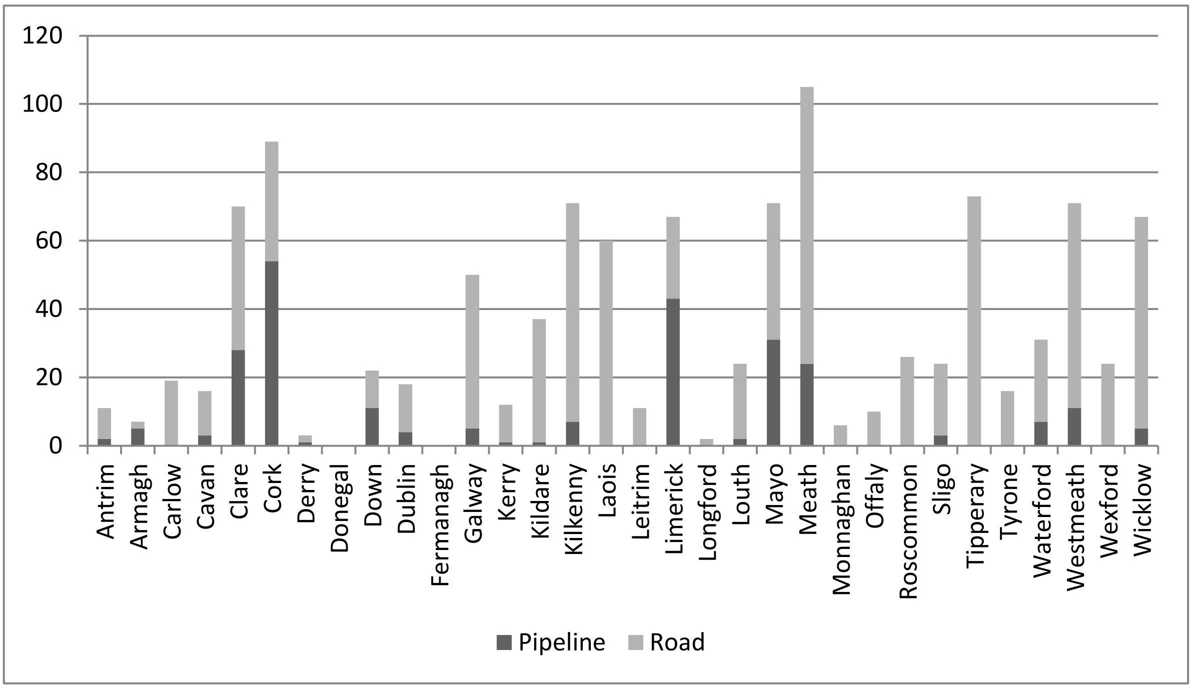

Figure 2.14. Number of burnt mounds excavated on road and pipeline schemes per county 1950 – 2010.

Burnt mound survival

A review of the published archaeological inventories indicate that 53% of recorded mounds in Ireland have been levelled/destroyed. An estimated 1100 spreads of 'burnt material' were recorded by the Cork Archaeological Survey (Power 1990), which highlights the vulnerability of the site-type in agriculturally intensive areas (Figure 2.12; Figure 2.13). This is further supported by the discovery of many unrecorded/levelled sites during recent archaeology and infrastructure projects. It has been estimated that between 30−60% of monuments have been removed since the mid-nineteenth century, and particularly in the last thirty years (Cooney *et al.* 2000). In 2001, a survey that measured the destruction of Ireland's archaeological heritage in seven study areas, estimated that of the 892 monuments visited, 154 (17%) had been interfered with (destroyed or damaged to varying degrees) subsequent to being recorded by the Archaeological Survey of Ireland (O'Sullivan *et al.* 2001). Of 154 monuments showing some degree of interference, 16.9% of were classified as burnt mounds. That study concluded that the monuments that suffered the most in the study areas were ringforts (40.3%) and burnt mounds (16.9%).

As low-relief sites, burnt mounds are vulnerable to destruction by the direct impact of modern human activity, and indirectly by natural forces such as trees/roots, erosion, flooding or burial under colluvial or peat deposits. Burnt mounds are vulnerable to erosion from livestock, especially in wet ground conditions in fields with high stocking rates (Figure 2.15). Similarly, the planting of forestry can also affect burnt mounds. For example, it was noted that at least three of the seventeen burnt mounds recorded as being within forestry in mid-Cork had been damaged by forestry-related drainage trenches. This reinforces the need for archaeological inspection of planting operations; it also highlights the general tendency to recognise only the highly visible aspects of archaeology. Cooney (1991: 70−71) warned that the focus on large and impressive site types tends to distract from other important, although less obvious sites. While drains and other ditches attest to significant disturbance of many sites in the archaeological record, recent excavations have shown that burnt stone material can also be re-deposited from other locations. This occurred at Gortnahown, Co. Cork and Keelty, Co. Clare (CE44) (Lyttleton and Doolin 2011; Taylor 2006), while at Coldwood, Co. Galway (GY24) preserved bulldozer tracks were found below the burnt mound deposits (O'Mahony and Delaney 2010). At Kilskeagh 3, Co. Galway, re-deposited burnt mound material was found in the ditch of an Early Neolithic enclosure (O'Neill 2013), while similar re-deposition of burnt mound material is recorded from the re-cuts of a number of ring-barrows and ring-ditches (Doyle 2005; Cleary and Hawkes 2014). At Langley Mill, north of Birmingham, a number of small spreads of burnt stone were uncovered with limited amounts of charcoal. The excavator suggests that this material had derived from nearby burnt mounds but had been re-deposited as a result of flood action. This is consistent with the association of burnt mound deposits with alluvial silts (Devaney 2008: 346), a phenomenon also identified at Rathduff Baley, Co. Kilkenny, along the M3 Motorway and on the Dunshaughlin to Castletown Tara Sewerage Scheme in Co. Meath.

Throughout the 1970s and 1980s, the European Union supported increased food production in Ireland through a range of agricultural grant schemes. This led to widespread reclamation of marginal land, extensive drainage works and the removal of hedgerows, resulting in the destruction of many archaeological monuments (Carey and Lynch 2011: 106). Burnt mounds were particularly affected by this process given they occur in poorly drained land. The fact they are not easily recognised by landowners as archaeological sites means that their significance is often not appreciated. In a listing of recorded burnt mounds in Co. Cavan (O'Donovan 1995: 31), no extant sites were observed, with seven levelled examples uncovered during archaeological monitoring in advance of a pipeline. In a county such as Wexford with extensive tillage, 86% of burnt mounds were recorded as levelled, only visible when areas are ploughed (Moore 1996: 19). Similarly, in Co. Laois, 82% of sites are also recorded in this state of preservation.

Some sites are also completely overgrown by shrub, which makes them extremely vulnerable to damage (Grant 2011: 116). Modern farming practices, such as tillage, have a significant impact on low-relief sites, and this incremental damage of archaeological features continues largely unchecked (O'Rourke 2006: 1). A recent study into the destruction of sites and monuments since the publication of county archaeological inventories concluded that land improvement was responsible for the destruction of 76.1% of monuments (O'Sullivan *et al.* 2001). While the Field Monument Advisory Scheme was set up to tackle such issues and liaise with landowners in relation to the care of sites and monuments on their land, the scheme has unfortunately declined during the recent economic recession. As of March 2010, only three Field Monument Advisors were working in the Republic of Ireland (Meenan 2011: 93).

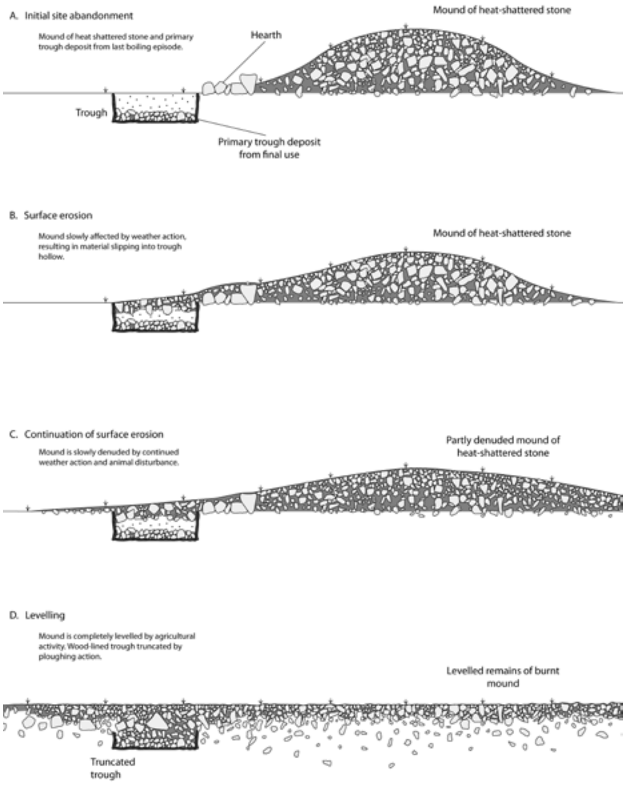

Figure 2.15. Post-abandonment history of a typical burnt mound. Drawing produced by James O'Driscoll.

2.6 RECOVERY ENVIRONMENT

Generally in Ireland, every effort is usually made to avoid archaeologically sensitive areas prior to infrastructural developments such as road and pipeline schemes. This is not always possible, because of the nature of agriculturally improved lands through which many routes pass, where recognition of unrecorded and levelled archaeological sites through desk-top analysis and field-walking alone is difficulat. This has been addressed by geophysical survey and the application of mechanised centre-line trenching with offset trenches every 15–20m to identify unknown areas of archaeological potential. Such test trenches are usually excavated in arbitrary levels of 0.1m using a toothless grading bucket. This method of archaeological monitoring has been very effective in identifying previously levelled burnt mounds as they are easily identifiable in test trenches due to the distinct nature of the burnt stone and charcoal-rich soil. Area testing is a variation of linear testing but involves stripping the topsoil in checkerboard fashion, in large test areas, rather than in continuous trenches. It is typically applied to locations such as arable river terraces, where no archaeological remains are known but the likelihood of former settlement is high (Dunne 2003: 67). Although previously unknown burnt mounds are easily recognised through these testing methods trench, the process of discovery can be damaging to burnt mounds, resulting in the removal of upper layers of these sites with a mechanical excavator. For that reason, the relationship between processes of site discovery and conclusions about the occupational history of a site need to be considered.

Burnt mounds revealed along a gas pipeline project in Co. Cavan were badly damaged by topsoil stripping (O'Donovan 1995). The same was recorded along gas pipeline schemes in the 1980s (Cleary *et al.* 1987; Gowen 1988) and early 1990s (Walsh 1995). The remains of a burnt mound at Kiltotan /Collinstown (WM20), Co. Westmeath was truncated by a test trench during archaeological monitoring and survived as a heavily disturbed layer mixed with topsoil (Richardson 2007). Similar damage during testing was noted at Newdown (WM12), Co. Westmeath, Cherryville (KD08), Co. Kildare (Hayes 2005; Breen 2008), and Newtown, Co. Dublin (DN06). This is a wider problem, with Maynard (2012: 122) observing that the damage caused to sites along the A55 Anglesey road scheme in north Wales made it difficult to define the extent of these sites, due to the spreading of material by machinery. Burnt mounds can sometimes be damaged during the construction phase of road and pipeline schemes

and in rare cases almost completely removed, as occured at Finniterstown, Co. Limerick and Clareabbey, Co. Clare (Hull 2003; Hull 2006). At Philpotstown, Co. Meath the site had been subject to unsupervised ground works in the interval between discovery and excavation, resulting in an extant burnt mound, measuring 12m x 5m x 0.5m being completely removed (Rathbone 2008). Unfortunately, other sites can also be vulnerable at this stage of road construction. A potential Bronze Age habitation site was completely removed by machinery at Lissatunny, Co. Tipperary during archaeological works in advance of the N7 Nenagh Bypass (Leahy 2010), while another unknown archaeological site at Greenhall Upper, Co. Kildare was destroyed prior to excavation along the Cork to Dublin gas pipeline (Cleary *et al.* 1987).

The component features of a burnt mound, such as troughs, hearths and areas of associated habitation, may also be affected by the process of machine stripping. The same can be said for other stone structural components commonly found on more extant examples such as mound revetments, platforms/trackways and stone stockpiles. It must be acknowledged, however, that in most of these cases, the burnt mounds were previously levelled and survived as dispersed/damaged spreads of heat-shattered stone underlying topsoil. Furthermore, these spreads and underlying pit features are often truncated by ploughing and the digging of land drains during later periods, with the result that at some sites, the internal corner posts of a pit is the only way to identify the feature as a trough used for water-boiling. In other cases, such as at Strangaloon Co. Clare (CE61), Monnany, Co. Monnaghan (MN03), Enniscoffey, Co. Westmeath (WM05) and Coolderry 2, Co. Tipperary (TY36), only the base of a timber troughsurvives, which can sometimes be confused with timber platforms also known from these sites (Chapter 4). The typical location of these sites in low-lying areas does assist in their natural burial, but also exposes them to land reclamation through the digging of drains and ditches. In many of the sites reported here (excluding examples protected by peat in waterlogged conditions) erosion of features by ploughing was extensive. However, in some cases where burnt mounds survive relatively intact, the methods of archaeological testing were damaging to the upper deposits relating to final use episodes.

Excavation strategies

Burnt mound excavations have changed significantly since the 1980s due to investigations connected to road, pipeline and private housing developments. More efficient archaeological planning in advance of these projects allows for an opportunity to investigate the entire extent of the site once it lies inside the agreed limits of excavation. Instead of test-trenching 'known areas' of archaeological potential, a detailed consideration of all levelled sub-surface remains is now included in the overall pre-excavation strategy, allowing features such as additional troughs, pits and ancillary structures to be identified. Rescue excavations no longer target specific features or areas deemed likely to yield more worthwhile information such as troughs and hearth locations (Lehane 1988; Cross May *et al.* 2005), thereby offering way more objective view of burnt mound site layout.

Once potential burnt stone deposits are revealed by methods of trial trenching during linear developments, the remaining topsoil is removed with the use of shovels, hoes and trowels in order to expose and identify the archaeological remains. A site grid is then set up at numerous intervals and subsequently calibrated to the national grid using GPS survey equipment. All potential features are then cleaned, recorded and excavated by hand using the single-context recording system. Where entire burnt mound deposits are revealed within road and pipeline corridors, the quadrant system is often employed with each segment of the mound material excavated separately before the latter is entirely is removed (Figure 2.16). Where only a portion of the mound lies within the road or pipeline corridor, the deposit is usually half-sectioned before being completely excavated (Figure 2.17). The same procedure is employed with underlying features such as troughs and pits which are usually fully excavated and sampled.

There is usually little or no attempt to excavate mound deposits stratigraphically due to the uniform nature of the coarse stony sediment (see Chapter 4). The burnt material is also usually spread out over large areas and generally assigned a single context number during excavation. While not specifically stated in many excavation reports, burnt mound material is sometimes removed by machine. This is probably a more widespread procedure undertaken during excavation due to time constraints, but also the perceived uniformity of burnt mound material and the general view taken by many that these sites will produce little in terms of cultural material, a point noted by Woodman (1981/82) in relation to disturbed archaeological contexts. Burnt mound material is also generally not trowelled, with most sites excavated using mattocks and shovels. As a result, small finds, fragmentary faunal remains and other environmental material can be overlooked in the excavation of waste-firing material where many of these remains would have been deposited. Variations in recovery also arise depending on the way a burnt mound site is excavated; for example, mound material might be removed rapidly, whereas the trough would be trowelled out meticulously. Variability can also arise as a result of differences in the experience of those involved in the excavation. The different recovery techniques employed during excavation and also in post-excavation analysis may also give rise to different interpretations. An example of this would be a comparison of features completely excavated by hand and those uncovered by machine stripping before manual excavation. The upper portions of the latter may be more uniform because they have been truncated, and vital evidence of tertiary fills may be lost. This is certainly a factor in relation to many burnt mounds investigated during road development, where only the bases of cut features such as troughs and pits survive.

Figure 2.16. Excavation of burnt mounds along the N11 road scheme at Ballyclogh North, Co. Wicklow. Source: Yvonne Whitty IAC Ltd and Transport Infrastructure Ireland.

Interpreting the complex inter-relationships of features, contexts, fills and material culture is key to understanding site formation processes, and the way they influence what becomes the archaeological record. In this regard, where pits/troughs display evidence of being intercut, there is often little attempt to distinguish particular phases. This is one of the main tools to construct the use history of a burnt mound site since it is often difficult to stratigraphically relate nearby cut features. Only in rare cases does mound material provide detailed stratigraphic information relating to the use-history of a site. Exposing relatively extant mounds for weeks prior to excavation will also undermine the integrity of a burnt mound site. At some sites, where troughs display evidence of re-cutting such as Leahy's, Co. Limerick, Cahiracon, Co. Clare and Ballinaspig 7, Co. Cork, complex use histories can be constructed. It is usually almost impossible to detect this information where multiple clusters of pits and troughs are found at a site and where radiocarbon dating is limited.

An environmental strategy is included in most burnt mound excavations, however it is often features exhibiting large amounts of carbonised material such as troughs, pits and spreads that are targeted for charcoal identification and radiocarbon dating. As a result, there is a tendency to sub-sample very rich areas or unique events, when a more consistent sampling strategy might be applied. Specialist work such as stone petrological analysis, lipid sampling, soil micromorphology and archaeobotanical analysis is not always possible or allowable within site budgets, and burnt mounds tend to be viewed as underserving of such analysis given the perceived likelihood of poor results. Relatively little environmental archaeology has to date been conducted on burnt mounds, and even less has been published (Grabowski 2008). The most common type of analysis focuses on charcoal and floral remains. Waterlogged layers can be subjected to more detailed palaeoenvironmental analysis, for plant remains, insects and pollen; however, few such studies have been undertaken for pyrolithic sites, even though they have much potential. In relation to burnt mounds, it is generally not possible to determine stratigraphically whether the mound was the result of numerous small burnings over a long period of time or a smaller number of larger heating events (see Chapter 4). Soil micromorphology and radiocarbon dating could be employed, as seen in examples elsewhere (Crowson 2004). If such analysis cannot be undertaken, charcoal from a burnt mound might be used in a Bayesian-type programme of radiocarbon dating to investigate the time-scale over which the deposit accumulated.

Figure 2.17: Elevated view of excavated troughs and burnt mound at Bockagh, near Ballaghaderreen, Co. Roscommon Source: IAC Ltd. and Transport Infrastructure Ireland.

As Bradley observed, 'field techniques have assumed a conventional character, so the people who use them may not realize that they were invented to answer specific questions whose details have now been forgotten' (2006: 4). With most burnt mounds encountered during infrastructural development, there is a particular reference to interpretation relating to function and behaviour rather than other problems such as chronology. Because of the general infrequency of artefact finds, determining the date and therefore the potential significance of features concerned is important. However, many burnt spreads that do not seal any cut features, or are not fully exposed within road or pipeline corridors, are often not selected for dating analysis. This is particularly the case for sites discovered along gas pipeline corridors (see Grogan *et al.* 2007; K. Cleary 2015). These sites feature relatively little in discussions of developer-funded projects for the simple reason that the excavated deposits were generally not selected for dating. (see Chapter 4 and 5). Few of these sites were intrinsically remarkable, but they can be locally important in that they represent the first significant examples investigated in a particular area.

Due to a general absence of diagnostic material culture at these sites, and an abundance of charcoal and wood, radiocarbon dating is the most widely used technique for dating. As with any archaeological excavation, the selection of datable organic material from a secure context is important. Ideally, where wooden trough linings survive, they should be sampled for radiocarbon dating as this should, in theory, provide a construction date for the site. A certain degree of caution must be applied here as trough timbers may be re-used from earlier contexts (the re-use of dugout canoes for example). It is also a possibility that troughs may have been re-lined at later stages. These timbers are not often selected for such dating even though in some cases wood analysis identifies that the timber is in good condition with evidence of wood-working. If preservation does not allow for dating, charcoal (or bone) should be selected from secure deposits relating to the use of pyrolithic/water-boiling technology, i.e. primary trough fills or undisturbed burnt mound deposits. As many of these sites survive as dispersed spreads of burnt stone, the selection of samples from secure contexts is important. Critical here is the degree of association between the sample and the context being dated (see Chapter 5). A recent study has demonstrated that a significant portion of later prehistoric radiocarbon dates from both commercial and other excavations are problematic in terms of sample quality and/or association (Becker *et al.* 2012). This is

also true of a number of burnt mound locations that have returned both early Mesolithic and medieval radiocarbon dates (Hawkes 2012; see Chapter 5). As Binford (1964) suggested, there is a need to apply research design to excavation in order to take account of the problems that an investigation is intended to solve. This requires a certain amount of forethought to determine what types of evidence would be expected on a site, and what would be expected if certain hypotheses were to be tested during excavation.

The major problem is whether these approaches are compatible with present infrastructure archaeology policies that determine how rescue excavations are carried out. Ideally, a series of dates should be obtained for any one deposit or archaeological context, since a single determination can be subjected to errors caused by a number of factors and statistical manipulation of a series of dates may produce a more refined result. The nature of archaeological excavation, especially on a commercial basis, can require decisions to be made quickly in the light of unexpected finds, external pressures from developers or budget and time constraints. This can often impact on the quality and the choice of samples taken, leading to poorly sampled material that could very likely be contaminated and give incorrect results (Barratt and Reimer 2007: 8).

The relative absence of animal bone at excavated burnt mounds may also be a reflection of soil preservation andsampling strategies employed on infrastructural projects in Ireland. The danger here is assuming that the absence of evidence is evidence for absence. As observed by Schiffer (1987), sampling strategies can be the reason something expected is absent or on the other hand, recovered and therefore deemed rare. Asthe disposal of burnt mound material would have been a context for the disposal of faunal remains, it is reasonable to argue that this material should be excavated carefully by hand during investigation. However, as mentioned previously, this is not always undertaken and relatively few samples from the burnt mound are taken for post-excavation analysis. While in a lot of cases, the burnt mound material is acidic and so one might not expect animal bone to survive, this need not be the case if the bone was burnt. As outlined in Chapter 6, most faunal remains recovered from burnt mounds survive in a fragmentary state and while on-site sieving of burnt mound material is probably not practical given relative time constraints on infrastructural projects, careful hand excavation should be applied or considerable sampling of spread or mound should be undertaken. Particularly in areas where bone does not readily survive, the use of soil chemistry may indicate where bones had been present. An example was illustrated at Lundfors in Sweden by Broadbent (1979) where stone tools were scattered around a relatively sterile area where phosphate concentrations were much higher. A sampling strategy including a combination of geochemical, geophysical and archaeobotanical analyses was employed by Radoslaw Grabowski in 2008 on a number of burnt mounds excavated along the N4 in Co. Cavan. The analyses presented detected indications of various factors such as the intensity of use of the burnt mound, the extent of disturbance around individual sites, as well as the spatial organisation of the spaces surrounding these features. The evidence seemed to point towards an interpretation of the burnt mounds as activity sites for the local subsistence economy, probably engaged in the processing of animal produce (Grabowski 2008). Possible functions could be fat extraction or meat preparation. Other processes involving animal produce may also have occurred, but the relatively low enhancement of phosphate in these sites suggests a very limited deposition of bones, pointing towards the processing of pre-treated animal produce. If pyrolithic sites were used in activities such as the slaughter and butchering of animals the phosphate levels would in all likelihood have been much higher due to a larger amount of bones being deposited *in situ*.

Palynology is another method that could provide additional data on burnt mound-related settlement in the area. By conducting pollen analyses on sediments from one of the many bogs or lakes in the area chronological control and additional data concerning the establishment of arable agriculture could be obtained. An early example is H. Feighan's unpublished University College Cork MA thesis on the pollen context of burnt mounds in the Burren, Co. Clare (Feighan 1985). Pollen analysis at Cahiracon, Co. Clare indicated a large clearing within woodland including oak, pine and alder on the margins of swampy land with slow moving water nearby (Grogan *et al.* 2007; see Chapter 7).

Although petrological analysis of the stones used in the pyrolithic process is rarely undertaken, it can often provide interesting results in relation to landscape setting and the possibilities of deliberate lithology selection (see Chapter 4). A recent examination of the material from Ballyadam, Carrigtohill, Co. Cork indicated that 'each burnt spread was composed of heat-affected sandstone that was not native to the area of underlying limestone bedrock' (Cleary and Hawkes 2013). Furthermore, the stone was identified as most likely sourced at a river-side cliff or bluff, with two possibilities proposed, one *c.*3km to the west and the other *c.*5km to the north-east (*ibid.*). Other sites, where local bedrock and glacial drift geologies are not used in water-boiling, include Clatragh, Co. Sligo and Poldrain, Co. Mayo. A number of experimental studies (e.g. Ó Néill 2009; Hawkes and O'Driscoll 2011/12) suggest that considerable effort was employed to achieve maximum heat output and a fixed number of water-boilings before additional stone had to be sourced. Regrettably, such detailed analysis is rarely undertaken and is generally seen as unnecessary. Charcoal identifications can also reveal certain wood species selected for fuel in the heating process and for associated structures (trough linings, hut structures, platforms/trackways). However, O'Carroll and Mitchell (2011) questioned whether excavators are taking representative samples from burnt mound sites, and are identifying enough charcoal fragments to determine wood function, use and reconstruction of surrounding woodlands. Current practice in Ireland is to identify 50 fragments per

Figure 2.18: burnt mound damaged by machinery at Gortnagane, Co. Kerry (SMR KE068-022012). Source: Alan Hawkes

sample where possible, whereas the average for burnt mounds is 25. As some pyrolithic sites have a long history of use activity, an optimum sampling strategy should be employed to establish different use phases. The periodic dumping of charred remains associated with pyrolithic activity might result in the mixing of wood species from different sources representing one or more burning events. The dispersal of this charred fuel debris across the site must also be considered, particularly where it enters open features or becomes mixed with sealing deposits.

Only by planning an investigation in a way that corresponds to outstanding research questions can relevant data be collected. As mentioned before, there have been some 1000 burnt mound excavations in Ireland since 1950. The reality is that archaeologists can probably excavate another thousand without ever gaining more information than what is already available as long as the traditional method of simply removing archaeological contexts and recording their superficial morphology remains unassisted by the methods of more specialised disciplines.

2.7 JUST ANOTHER BURNT MOUND?

In recent years there has been much debate among State heritage bodies and development agencies as to the need for further excavation of burnt mound sites in Ireland. Because they are seen as a uniform site type, there is a tendency to assume they do not have potential to yield new information or finds. As a consequence, these sites appear to have been regarded as an expendable resource. As Ó Néill (2000: 19) has observed, this attitude is taken not only by engineers and project managers on large development projects but sometimes even by archaeologists, who typically refer to them as 'just another burnt mound'. The reality is that the excavation record reveals a wide range of site types, some of which employing different pyrolithic applications. Some sites have a standardised layout suggesting their use as cooking places, or in rare examples, sweathouses, while others have evidence of more specialised use, possibly relating to feasting. One of the objectives of this publication is to highlight the variability within this category of site, and the significant potential they hold for future investigation.

Due to the density of these sites, it is not generally realistic to restrict large-scale infrastructural development to preserve a burnt mound in situ (Ó Néill 2000a: 19). Generally, the route option with the lowest predicted impact will be the most preferred option, although many other considerations come into play. In determining a proposed road or pipeline route, it is probably more cost

effective to excavate a burnt mound given the size and nature of the monument, rather than a large monument such as an earthwork, that would certainly be more time and labour intensive. At the same time, due care must be taken with regard to burnt mound investigations, which is not often the case with certain sampling and excavation techniques (see above). This is confirmed through the evaluation of many excavation reports which have become considerably standardised in recent years with the same generic discussion of the excavated evidence. While the majority are of a fair-to-good quality, a large number require further post-excavation analysis and interpretation prior to publication. Only a very limited percentage (an estimated 5%) are suitable for immediate publication (Cooney *et al*. 2006).

Reference has been made to the grading of monuments for which no formal system currently exists in Ireland. In essence, grading provides a means of assessing the relative value or significance of a monument. However, the meaning of value in archaeological terms has long been debated and is very subjective (Sharma *et al.* 2003: 4). If a ranking system was introduced to Ireland burnt mounds would surely not be graded at the higher end of the scale due to the densities of sites around the country, the large numbers excavated in recent years, and the general view that they offer very little in terms of new information. The first question that is asked of any site/ monument being considered for protection is whether it is of sufficient importance, based on specific criteria, to qualify for legal protection. Archaeologists routinely make comparisons between different monuments and sites. In mitigating the impact of development, known sites recorded in the *Record of Monuments and Places* are avoided and assessments are made to identify and rank the significance of sub-surface features. Mitigation-stage archaeology already distinguishes the relative significance of such sites. In this context, archaeologists are already de facto operating a grading system (Cooney *et al.* 2006). A report on monument grading systems was commissioned by the Heritage Council in 2003 (Sharma *et al.* 2003). As detailed in that report, the significance of components of the architectural heritage in Ireland has since 1990 been assessed according to their international, national, regional, local or other significance. Being largely above ground, the architectural heritage is clearly more amenable to grading than archaeological features. The establishment of formal grading systems for archaeological sites and monuments was seen to present formidable difficulties. Moreover, it would hardly be feasible unless a nationally

Figure 2.19: Early Bronze Age burnt mound damaged by machinery at Errarooey More, Co. Donegal (RMP DG025-007). Source: Alan Hawkes

agreed archaeological research agenda had already been formulated (Sharma *et al.* 2003).

While all monuments should be managed to secure their continued survival, in practice not all monuments can be preserved and burnt mounds are high on the list of site-types at continued risk in Ireland. Current legislation provides protection for all known and newly discovered monuments under a two-tier system. The first involves monuments in the ownership or guardianship of the State or under a legal preservation order, while the second involves all other monuments listed in the *Record of Monuments and Places* (RMP). This protection does not necessarily ensure the future physical survival of particular monuments as there is little effective monitoring or management of this heritage in place. There continues to be a reliance on members of the public to recognise a monument like a burnt mound on the ground, and then report damage to that site when it occurs (Figure 2.18). As observed by O'Sullivan *et al.* (2001) how many tourist books or posters contain images of burnt mounds or other earthen monuments? By maintaining such perceptions, the question might be added whether the selective representation of Ireland's archaeology for commercial purposes having an adverse effect on the preservation of earthen archaeological monuments.

It must be accepted that archaeological sites and monuments cannot be given an absolute value, because by their very nature each site, no matter its classification, is entirely unique. In addition, cultural heritage can gain or lose value as values change, and because knowledge and understanding of a monument or site are not static, but develop over time (Sharma *et al.* 2003). This is true for burnt mound archaeology which has changed significantly in recent years resulting in very different site-types emerging from development-led archaeology with some sites employing pyrolithic technology for very specialised purposes (Chapter 6). It is recognised that attributing value is a subjective process based on current information and professional judgement, and so the importance attached to a monument or site cannot be a definitive statement about that cultural heritage.

Chapter 3

Pyrolithic technology: the international context

This chapter outlines the international dimension of the burnt mound phenomenon with particular reference to the British archaeological evidence. A broader discussion based on the use of pyrolithic technology in prehistoric cultures in western and northern Europe will be considered in relation to ethnographic sources. While the technology has a broad usage across many different cultures and chronological boundaries, the deliberate mounding of burnt stone associated with pyrolithic water-boiling in timber-lined pits seems to be a phenomenon unique to Britain and Ireland.

3.1 PYROLITHIC TECHNOLOGY AS A GLOBAL PHENOMENON

Pyrolithic technology is an internationally recognised phenomenon with deposits of burnt and fire-cracked stones found in many prehistoric cultures. These processes are often associated with cooking, involving an indirect application of heat to roast, boil or steam food. It is unclear as to when human societies began to use heated stone in this manner. One of the earliest European sites to feature burnt stone/pyrolithic deposits is Les Eyzies in the Dordogne region of France, where small pits were filled with deposits of heat-shattered river cobbles dating to the Late Aurignacian, *c.*33,000–32,000 BP (Movius 1966; Figure 3.1). Burnt and heat-fractured quartz pebbles were identified at a Late Upper Palaeolithic settlement site at Gönnersdorf, Germany (Bosinski 1979). Subsequent experiments (Batchelor 1979) suggested that the stones were heated to high temperatures and rapidly cooled by water, though it was also noted thatsimilar fracture patterns occur on stones used for roasting or steaming. Deposits of fire-cracked stone, also dating to the Upper Palaeolithic, were uncovered at El Mirón Cave in Northern Spain (Nakazawa *et al.* 2009), with similar evidence from a Gravettian (*c.*25000 BP) open-air site occupation of Vale Boi in south-western Portugal (Bicho *et al.* 2003). Burnt stone deposits were uncovered in the Late Neolithic lakeshore settlements in Western Switzerland and Eastern France (Strahm 1972–73; 1974–75; Furger 1980). Kubiak-Martens (2002: 41) suggested that pit cooking was likely to have been a common practice in Mesolithic Europe on the basis of archaeobotanical and archaeological evidence, suggesting that this technique would ‘enhance the flavour and digestibility of root foods’ as well as ‘help to preserve food for storage’. Burnt stone deposits in hearth-like features recorded at rock shelter sites along the Middle Danube and Upper Elbe rivers (Svoboda 2008: 233) are also interpreted as boiling pits. Cooking pits are not uncommon in Stone Age sites in Scandinavia (e.g. Kubiak-Martens 2002, Fretheim 2009). These features are defined as having ‘a marked charcoal layer at the base and a compact filling of fire-cracked stones in the layer above’ (Fretheim 2009: 379). Miracle (2002: 76), observes that at Pupicina Cave, Croatia, land snails were boiled and steamed using this method.

Pyrolithic technology has also been recognised in early Stone Age cultures in other parts of the world. There are numerous examples from central and western North America dating from at least 10,500 years ago, involving hot-stone cooking features such as surface griddles, earth ovens, steaming and boiling pits (Thoms 2009: 573; Johnson 2009). Burnt rock middens are recorded in central Texas, relating to the roasting or baking of foodstuffs using hot stones in unlined pits (Johnson 2009; Black *et al.* 1997; Kelley and Campbell 1942). The evidence suggests that these sites were used by nomadic tribes for episodic cooking. In Canada, the use of hot stones for cooking is a well-documented practice from ethnographic records (Campling 1991), with examples including a huge bison ‘kill complex’ at the Porcupine Hills in south-western Alberta where hot-stones were used in boiling pits and earth ovens (Brink and Dawe 2003).

In north-west Europe the phenomenon is quite different and is mainly associated with burnt mounds, where it is generally assumed that a pyrolithic water-boiling technology was employed to heat water held in open-air sunken pits (Waddell 2000; Ó Néill 2009). Ancillary

Figure 3.1. Burnt stone deposits at Les Eyzies, Dordogne, France. Source: Movius 1966.

features interpreted as roasting ovens/steaming pits have also been recorded (see Chapter 4). Timber-lined troughs associated with burnt mound deposits are only found in this part of north-west Europe. The basic principle of pyrolithic technology involves a method of heat transfer from one place to another using hot stones, but several variants of this technology are recorded in the archaeological record (see Chapter 6).

While the burnt rock mounds of North America are generally free from charcoal, the burnt mounds in Northern Europe have a high charcoal content due to sites being used over long periods of time and hearth material being raked out and dumped within the mound material. The general absence of formal hearths at many sites may suggest that hearths 'made the mounds' and were not separate entities or they may have been positioned on existing burnt mounds, providing a dry platform in an otherwise waterlogged area. Such fires are unlikely to leave any archaeological trace, though their presence may be indicated by concentrations of charcoal in some burnt mounds (see Chapter 4). It has also been suggested that pyrolithic water-boiling requires large amounts of fuel to heat the stones to high enough temperatures (Nelson 2010; Thoms 2009). This may also explain the presence of large amounts of charcoal in the mound material. Burnt mounds tend to be located on marginal areas between dryland and wetland contexts, and charcoal identifications seem to support this interpretation (O'Donnell 2007). In most cases the users had easy access to woodland, with pollen analysis pointing to forest clearance in the immediate vicinity of these sites (*ibid*.: 38).

Indirect cooking using hot stones is a method that post-dates the adoption of direct, open-fire methods by approximately 100,000 years (Thoms 2009: 573). In summary, the technique was used for prolonged cooking in various types of pit features with various ethnographic accounts describe the method commonly used for rendering foods more nutritious and digestible (Wandsnider 1997; Peacock 1998). As already mentioned, in Ireland the technology has generally been associated with burnt mounds and pyrolithic water-boiling (O'Kelly 1954; Waddell 2000), as features associated with roasting and steaming are difficult to identify archaeologically. Unlined pits of varying sizes often accompany timber-lined troughs. Many examples do not display evidence for in situ burning making interpretation difficult, but they may have functioned similar to examples found in North America (Thoms 2008).

3.2 PREHISTORIC BURNT MOUNDS IN BRITAIN

As well as having a dense distribution in Ireland, burnt mounds are also known in many parts of Britain (Figure 3.2). Current estimates indicate that there are *c*.3755 recorded sites (Thelin 2007), most of which have not been archaeologically investigated. Particular concentrations are recorded in northern Britain, most notably in the Scottish Isles where there has been extensive survey (Hedges 1977). The term 'burnt mound' has been used in Britain for some time, although 'boiling mounds' or 'pot-boilers' also feature in the literature. While some burnt mounds in the Scottish Isles are more substantial, displaying evidence of stone structures (see below), burnt mounds in other parts of Britain generally conform to the basic characteristics of Irish burnt mounds. They can be defined as low mounds of heat-affected stone and charcoal which often overly a number of features such as troughs, pits, hearths and stake-holes.

Several factors have hindered the discovery and recording of burnt mounds in Britain. Cowley notes that their distribution is uneven with several distinct regional concentrations (2011: 47). This is due to patterns of archaeological fieldwork in different parts of Britain by experienced individuals. For example, prior to the revision of the basic scale maps of the Orkney and Shetland islands, the Ordnance Survey field personnel had little experience of burnt mounds, and so very few were identified on the islands (Halliday 1990: 61). Therefore, burnt mound distribution will continue to be affected by certain biases such as targeted surveyed areas and large-scale infrastructural development (Maynard 1993: 50). The Glenesslin Survey, for example, focussed the majority of their operations within upland and marginal land inside specific National Grid squares giving a distribution oriented towards the marginal land areas. Maynard (1993: 50) highlighted that the Dumfries and Galloway pipeline project has shown that burnt mounds often occur in areas of more intensive agriculture where many have been destroyed or concealed. This indicates that burnt mounds are vulnerable in the British landscape just as they are in Ireland. Hedges (1977: 42) observed that the burnt mound at Liddle I in Orkney was quarried away for road metalling by the land owner. Bullows recorded the same in the English Midlands where 'hundreds of cartloads of potential pot-boilers (burnt mounds) were collected by the unemployed and used for mending the Sutton roads' (1927: 296).

The distribution of burnt mounds in Britain continues to increase as new discoveries are made. This is helped by a greater understanding of their occurrence and significance (Crowson 2004: 36). The International Burnt Mound Study Group meeting held in Dublin in 1988 provided the first forum for a review of burnt mounds in Britain (Buckley 1990; Barfield and Hodder 1991). Several regional studies were subsequently undertaken in parts of Wales, Scotland and England (Anthony *et al.* 2001; Anthony 2003; Thelin 2007; Doughton 2014). There has yet to be a national study of prehistoric burnt mounds in Britain.

Antiquarian Interest

Antiquarians in Britain were investigating and documenting the occurrence of burnt mounds from the nineteenth century. One of the earliest references comes from Mitchell's investigations on Shetland in the Scottish Isles. When discussing a recently discovered underground

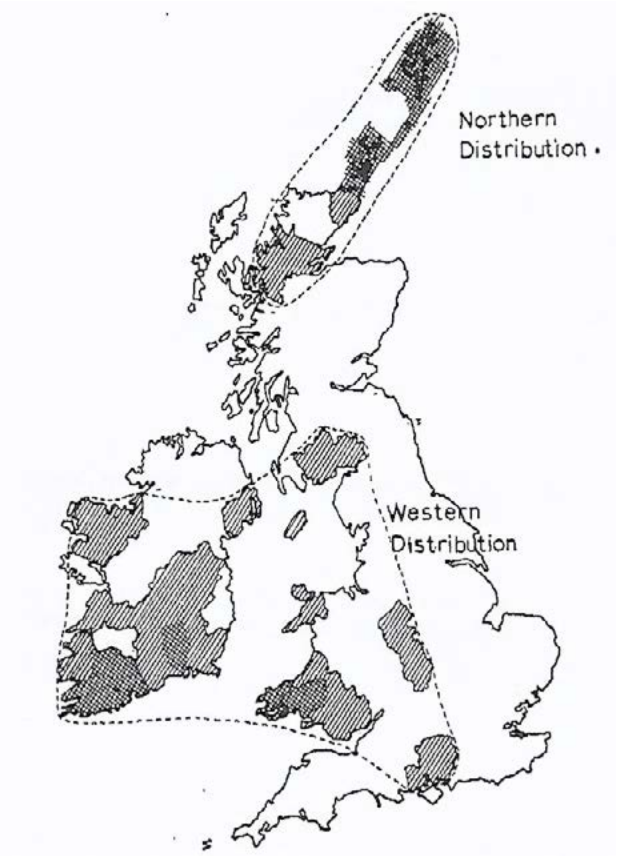

Figure 3.2. Distribution of burnt mounds in Ireland and Britain. Source: Hedges 1974–75: 62.

passage, he notes the existence of a large tumulus close to the structure. When the mound was examined it was found to consist of 'small broken stones (which had been exposed to the action of fire), and to contain a built chamber, in a state of too great ruin, however, to permit of its plan being made out' (1867: 121). He also mentions other burnt mound sites in the area and states that 'many, both of the large and small green tumuli in Shetland consist of small burnt stones- not water-worn and rounded but irregular and angular fragments of large stones'. Morrison (1870) also makes reference to these sites while investigating a field with some 'ancient dwellings' in Urquart. He recorded;

'*black mossy-looking patches', very noticeable amid the light coloured sandy soil' and on clearing away to a depth of about fifteen inches, met beds of ashes and charred bits of wood, with occasional fragments of pottery and small stones that had been in the fire* (*ibid.*: 255).

He also noted a great number of pits in the general area, 'which must have been honey-combed with them; and burned stones are scattered about in all directions' (*ibid.:* 255). Anderson's (1871: 293) investigations at 'Kenny's Cairn' in Caithness recorded a chamber much like the example excavated by Mitchell, built of stone and divided into two compartments. He records that the;

'*whole floor of the main chamber and of the passage, more than halfway outwards, consisted of an accumulation of ashes and broken and burnt stones, about a foot in depth, impacted so closely that it rose to the pick in cakes, and was with difficulty reduced to a sufficiently friable condition to be examined for included remains'* (Anderson 1871: 293).

He also recorded a trough, describing it as;

'*a short cist, with the sides driven in, but, with the exception of charcoal, cinders, vitrified stones, and a few bits of bones, some of which were burned and some unburnt, we found nothing* (*ibid*.: 296).

He alludes to a culinary process as suggested by contemporaries in Ireland (Hackett 1885), but was convinced by a possible burial function. He states that 'in their dimensions they are more like coffins than cooking pots; and burial in such hollowed tree trunks is a well-known sepulchral usage' (Anderson 1871: 296). This site however, most likely represents a burnt mound with a structural component similar to those uncovered in Shetland and Orkney (see below).

Calder (1963–4: 78) mentions that even as late as 1946 the origin and purpose of burnt mounds in Shetland was still a matter of uncertainty, with grass-covered mounds often mistaken for burial cairns marked on the O.S Maps as 'Knowes or Tumuli'. Black (1866: 324) refers to cairns in Shetland containing circular or nearly circular gatherings of small stones, called by the inhabitants 'Fairy Knowes'. The function of these mounds was not apparent at the time, but there was an awareness that the stones were subjected to intense heat.

During the early twentieth century, burnt mound investigations became more common in Britain, leading to a number of experiments to examine their use (Cantrill 1911; Laynard 1922; Bullows 1927; Cubbon 1965; Pasmore and Pallister 1967). Sites excavated in Wales, Norfolk, Warwickshire and Hampshire contained unlined pits interpreted as 'pot-boilers'. These were compared to ethnographic examples, where pits were lined with skins and;

'a hole is dug in the ground, about the size of a common pot, and a piece of the raw hide of the animal is put over the hole, and then pressed down with the hands close around the sides, and filled with water. The meat to be boiled is then put into this pot of water; and in a fire, which is made close by, several large stones are heated to a red heat; these are successively dipped and held in the water until the meat is boiled' (Cantrill 1911: 255).

Bullows (1927: 298) tested this hypothesis where 'a suitable hole was dug, and lined with sheep-skin'. These stones after being used resembled exactly the broken stones in the mound'. Laynard referred to an experimentation of prehistoric cooking in Norfolk, where he 'made the experiment of boiling mutton in a pan of water heated by some of the actual stones from the cooking place at Buckenham Tofts. To keep the meat simmering for twenty-

five minutes or more, involved the continual addition of red hot flints' (1922: 489).

Excavations in Ireland at this time produced little in terms of artefacts or animal bone, leading some to question that these sites functioned as cooking-places (Forsayeth 1913). Contemporary investigations into British burnt mounds produced a number of artefacts, including animal bone. Laynard (1922) for instance mentions that 'a number of teeth of oxen came to light' and a great quantity of worked flint was also uncovered (Figure 3.3). Pottery is also a common find among the British burnt mound sites especially in the Scottish Isles (see below). In Norfolk, Laynard (1922: 491) investigations also uncovered 'two sherds of a coarse red pottery, containing large quartz grains,' while a burnt mound site at Deadman Bottom in the New Forest contained a trough that produced nine sherds of pottery and a number of tiny fragments (Pasmore and Palister 1967: 18).

Influenced by O'Kelly's work in Ireland, a number of more wide-ranging excavations were conducted in the 1960s, employing more scientific methods of environmental sampling, dating and analysis. Calder (1962) undertook a comprehensive survey of burnt mounds on Shetland, while Cubbon (1964) carried out one of the first scientific excavations on the Isle of Man. The study of burnt mounds in England was concentrated in the New Forest area in the south (Pasmore and Pallister 1967), however, in 1971 a site dated to the Bronze Age that produced prehistoric pottery, worked bone objects, a clay spearhead mould, a series of lithics and animal bone was excavated at Sandy Lane, Gloucestershire (Leah and Young 2001).

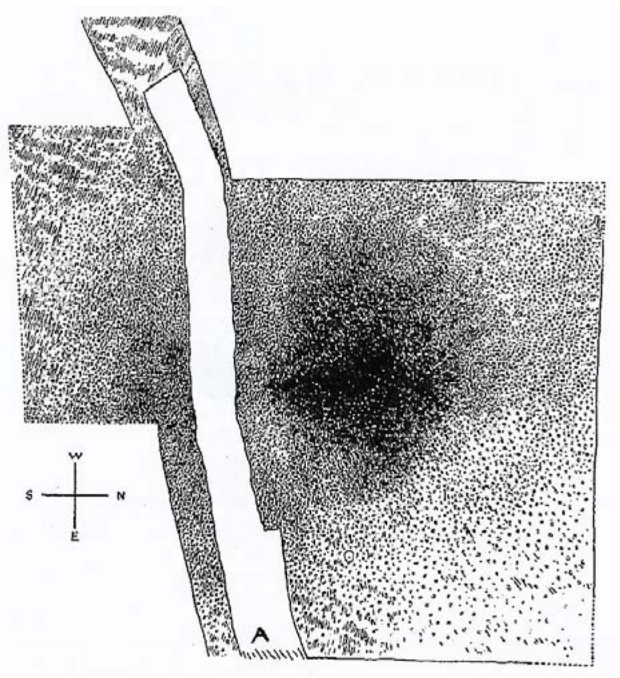

Figure 3.3: Plan of 'heated stones' at Buckenham Tofts Park, Norfolk. Source: Laynard 1922: 490.

Burnt mounds in Scotland and the Northern Isles

Burnt mounds have been recognised in Scotland for over a centurybut have received relatively little attention until recent times. They are particularly numerous on the Scottish mainland, and in Orkney, where 800 sites have been recorded since Hedges study in the 1970s (Halliday 1990: 60). It is now estimated that some 1800 burnt mounds are recorded in Scotland, with some areas exceeding 30 per square kilometre (Cowley 2011: 45; Anthony 2003: 43). This makes it the most common prehistoric site type in this part of Britain.

Anthony (2003: 46) states that fewer than 3% of burnt mounds in Scotland have been examined in detail through excavation, with information collected through field survey available for other burnt mound sites. Some 45% of these mounds have no recorded shape, while 36% are recorded as being crescent-shaped in plan and 11% are oval. The rest are recorded as being either irregular, pennanular or amorphous (*ibid*.: 51).

Modern infrastructural projects account for a growing number of previously unknown burnt mound sites in Scotland (Maynard 1993; Banks 1999; Cressey and Strachan 1999; Donnelly and MacGregor 2006). Like Ireland, such projects emphasise the vulnerability of these sites in agriculturally sensitive areas. For instance, a pipeline project in Dumfries and Galloway uncovered a large number of burnt mounds during topsoil stripping, whereas preliminary archaeological survey along the same route only identified five extant mounds (Maynard 1993: 50). In south-west Scotland, archaeological works in advance of a new sewer pipeline at Gallow Hill, Girvan identified thirteen burnt mound deposits in a very low percentage of the total area (Donnelly and MacGregor 1996: 64), while road development at Clydesdale revealed further sites at Crawford and Muirhead (Banks 1999). Seven burnt mound sites were identified in advance of industrial development at Grants Distillery, Girvan (Banks *et al.* 2008), with two burnt mounds excavated as part of a water pipeline route in 1999 at Beechwood Farms, Inverness (Cressey and Strachan 1999: 196). A well-preserved wooden trough uncovered at one of the sites contained small fragments of undiagnostic burnt bone which were recovered through flotation of samples (*ibid*.). Three of the excavated troughs had associated channels, possibly used as water-drainage features.

In the Scottish Isles, burnt mound clusters appear in Orkney, Shetland and Dumfriesshire, all areas extensively surveyed by the Royal Commission over the past few decades. Parry's archaeological survey of Shetland in the 1940's suggested that single and groups of burnt mounds accounted for almost 9% of the entries in the inventory (Hedges 1984: 47). Calder (1960) added a further burnt mounds to the Shetland Isles, but it was the excavated sites of Liddle and Beaquoy that brought much clarity to their date and function. These sites, along with others in the Scottish Isles, produced stone structural components when

Figure 3.4. Burnt mound during excavation at Liddle, South Ronaldsay, Orkney. Source: Hedges 1975; RCAHMS.

excavated. Hedges (1974–5: 66) attributes this use of stone to environmental factors associated with the scarcity of wood resources in the Northern Isles. Moore and Wilson's (1990) burnt mound survey identified nineteen sites in Shetland vulnerable to erosion, five of which produced evidence of stone-built structures.

The burnt mound at Liddle on Orkney mainland, overlay a substantial structural component with a large stone-lined trough surrounded by a low wall, interpreted as the remains of a building (Hedges 1974–5; Figure 3.4). Excavation of another Orkney site, Beaquoy, uncovered two walls or buildings, with the second surrounding a large circular pit lined with yellow clay which was used as a trough. Both Liddle and Beaquoy also contained separate compartments and quoined well-like structures (*ibid.*).

A similar burnt mound was excavated at Meur, Sanday, also in the Orkney Islands (Toolis 2005). The site consisted of a stone-lined trough surrounded by a wall similar to the sites mentioned above. It was associated with a compartment and a corbelled well structure with an overflow drain. The site was surrounded by a mound of dark soil and burnt stones. The burnt mound at Meur, Sanday, shows obvious similarities to the structures excavated at Liddle and Beaquoy in the Orkneys. All of these mounds were comprised of fire-affected sandstone, ash and charcoal. Peat was the primary fuel used at Meur mixed with heather and seaweed, with wood charcoal largely absent (Toolis 2005: 42). Animal bone from the site is radiocarbon dated to the Late Bronze Age, with an Iron Age phase also recocognised at the site.

The existence of burnt mounds on Shetland has been noted since the nineteenth century when Black (1857) refers to as 'Fairy Mounds'. However, it is not until the 1970s that these sites were archaeologically investigated. The site of Ness of Sound, Lerwick was excavated in 1972, but remains unpublished. The recorded features resemble those excavated by Hedges in Orkney, where the cooking trough and hearth were set within an oval structure. The site at Toughs, Burra Isle contained a rectangular building on the southern side of a burnt mound (Hedges 1986: 27). Features include a conjoined hearth and cooking trough in the northern corner of the building partitioned by a large boulder on edge. Recent excavation in Shetland uncovered further burnt mound sites with associated structures (Figure 3.5), some of which were possibly connected to activities such as sweating (Moore and Wilson 1999). It is now accepted that 'burnt mounds in Shetland are not a homogenous class of site and this variety has not been adequately accounted for within the prevailing models' (*ibid.*: 203).

Burnt mounds excavated at Ceann nan Clachan, North Uist, were found to have formed around a small, sub-oval structure, which lacked the usual indicators of domestic activity (Armit and Braby 2002: 229). Three phases of activity are recorded, beginning with the construction of an oval building and formation of burnt mound material,

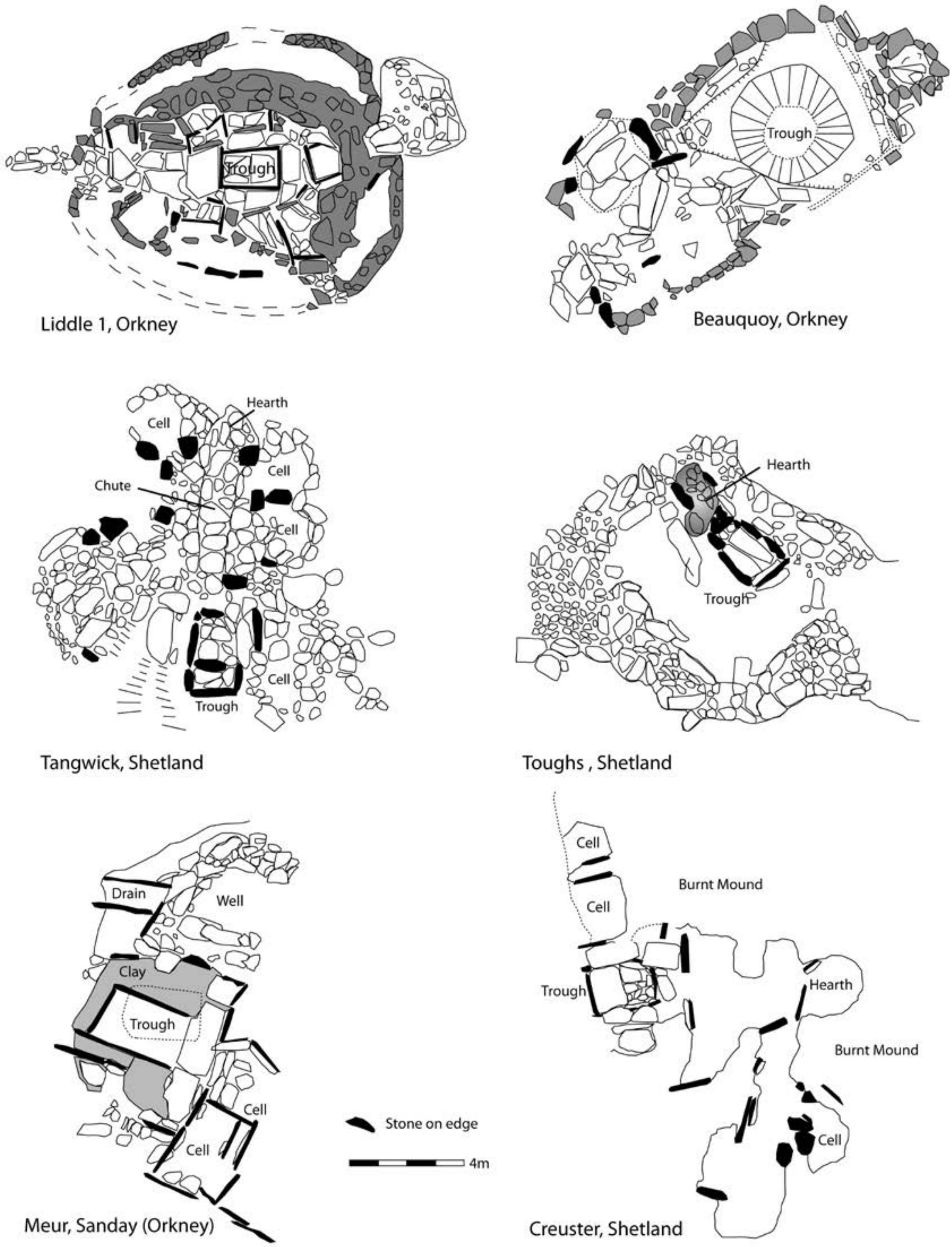

Figure 3.5. Range of burnt mounds in the Scottish Isles with internal troughs and associated stone-built structures. Source: redrawn after Hedges 1975; Moore and Wilson 1999; Hedges 1986; Toolis 2005; Moore and Wilson 2008.

the replacement of structure one with a cellular building, and finally, the abandonment and limited re-use of part of the cellular building (Figure 3.6). With the absence of a trough and the paucity of finds, the authors postulate that this might have been a specialist structure, such as a sauna or sweatlodge. They suggest that stones would have been heated outside the building in 'an external fire' (macrofossil and soil micromorphological analysis indicate the stones that formed the burnt mound were not heated on the same hearth that produced the ash dumps excavated in structure one) and transported back into the building and applied with water. The drain feature may have acted as a channel bringing the condensed water back out under the threshold of the building (*ibid*.: 237).

The excavators proposed that the evidence from structure one indicates a sweating function using steam, while the second structure on the site differs due to a recessed hearth in the south west cell. Because of this, and the presence of the 'fire-box' in the middle cell, the authors suggest a 'switch from the use of steam to dry sweat-bathing between phases 1 and 2, with the associated changes in structural design and methods of supplying heat to the building' (*ibid.*: 254). One argument for the interpretation of these structures as sweathouses is that both sites were roofed. It is interesting to note the similarities between structure 2 and a contemporary house site excavated at Cladh Hallan. Armit and Braby observed the 'presence of a central hearth in the larger cell, and the absence of a hearth in the inner is a further detailed point of comparison between the two buildings' (*ibid.*: 255). Another comparison is the re-use of both structures after a period of abandonment. At Cladh Hallan, the innermost cell was re-used for activities involving the deposition of burnt stone, with possible uses including steam bathing or the smoking of fish (*ibid*.).

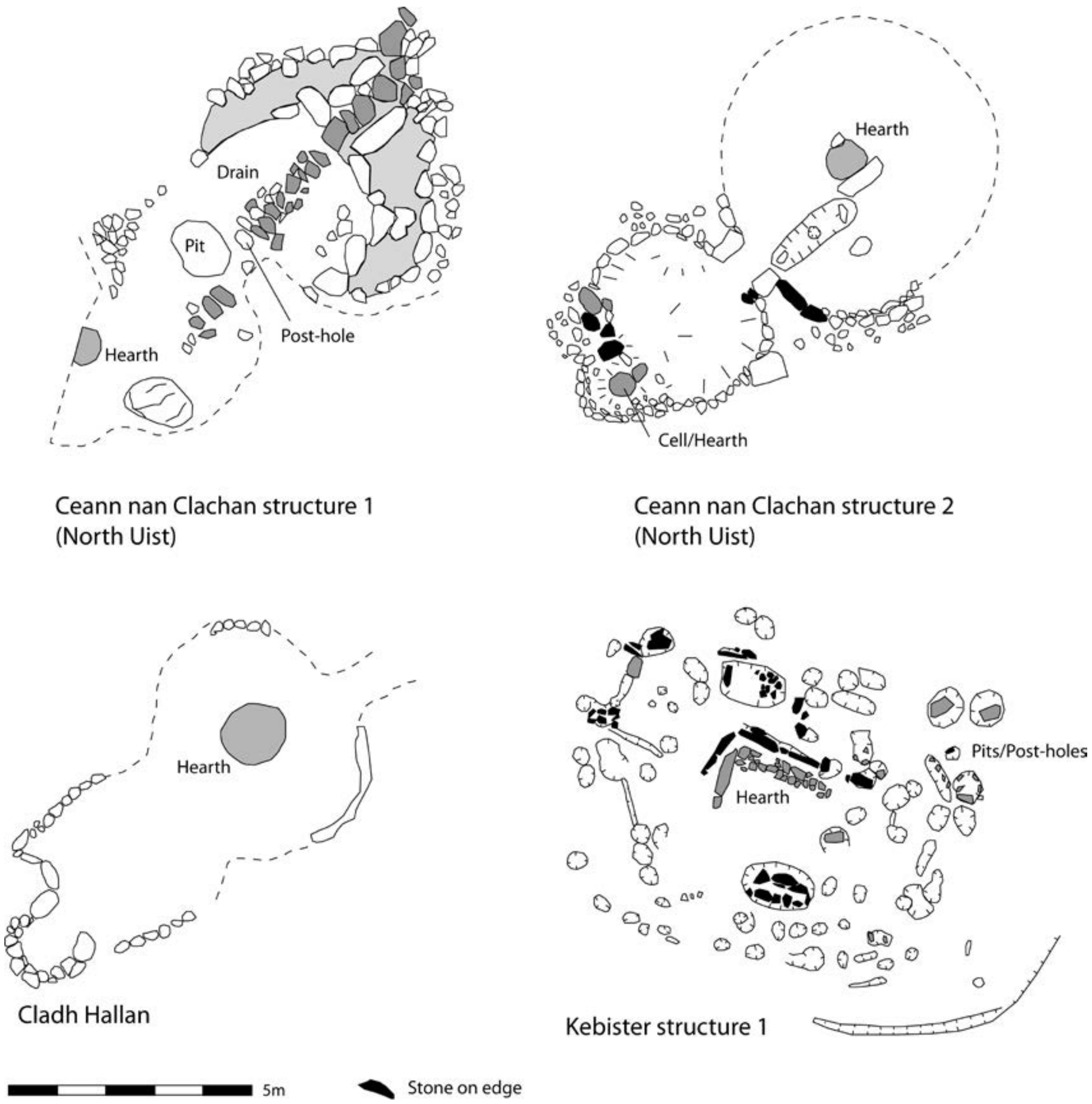

Figure 3.6. Possible sweatlodge structures at Ceann nan Clachan , North Uist (Phase 1 and 2) and Cladh hallan (bottom left). Kebister structure 1 (bottom right) is a timber-built building interpreted as a cook-house. Source: redrawn after Armit and Braby 2002, Owen and Lowe 1999.

The site at Tangwick was associated with a large burnt mound and an oval structure, with the latter divided into a series of cells which were arranged around a central chute leading to a stone-lined tank. This chute was interpreted as a channel to direct hot stones from the hearth (located in cell D) to the tank. The excavators noted that 'the base and sides of this feature were lined with stones which were reddened and abraded in a manner consistent with heat damage' (Moore and Wilson 1999: 213). This structure was also interpreted as a roofed building, with each cell possibly having a corbelled roof. It was suggested that the smaller cells must have been used for storage due to their size, while the larger ones may have been associated with the use of hot stone technology (*ibid*.: 213). As such 'when hot stone was being processed, the effects of heat, steam and shattering stone would have rendered a large part of the structure inhospitable and movement within the structure must have been severely restricted' (*ibid*.: 230). Thus it would seem that Tangwick represented a highly specialized site related in some way to cooking, but not of a domestic nature; possibly some type of 'seasonal feasting area' (Anthony 2003).

At Cruester, Bressay, a substantial L-shaped building was uncovered overlain with burnt mound material (Moore and Wilson 2008). The interior comprises a number of small cellular 'rooms' that the excavators suggest do not appear to have been used as part of a residential house. The layout of the building included a cellular kiln-like structure, a stone-lined tank and a cistern, which appear to have been designed in combination to facilitate the heating of water (*ibid*.: 11). This site together with the other examples on Shetland, form a distinctive class of burnt mound, with similarities to some Orcadian sites.

The only timber structure associated with burnt mound material in the Northern Isles of Scotland was uncovered at Kebister, Shetland (Owen and Lowe 1999). It was composed of the truncated remains of a sub-rectangular building defined by a double ring of posts. Within the interior was a large central hearth, two large cooking pits with deposits of fire-cracked stone and an internal conduit for water drainage (*ibid*.: 255). Although no burnt mound material was found associated with the structure, this may be explained by the high degree of truncation recorded. The site was also cleared and levelled when an Iron Age structure was built on its footprint. There was no indication of domestic habitation or internal compartments similar to the previous examples, with the excavators observing that there was 'little space left in the interior for other fittings or activities. The size of the structure can be compared to the aforementioned stone-footed building at Toughs, also on Shetland, which measured *c.*4m by 3.2m internally. Due to a series of unreliable thermoluminescence results, the site is not securely dated however, the excavators suggested that the structure is more likely to be from the Early to Middle Bronze Age. This can be supported by the recovery of Bronze Age pottery from the fills of some of the post-holes. The building was interpreted as a specialised cook house, based on the substantial hearth and associated water-boiling pits and water channel (*ibid*.).

Ó Néill (2009: 143) states that as many as ten stone-footed buildings associated with burnt mounds are recorded in this part of Scotland. These can be classified into a single-celled, ante-chambered or multi-celled structures. Furthermore, he notes that single-celled structures were roofed and the presence of internal hearths and pits suggests that they functioned as some form of steam bath. The ante-chambered structures seem to have evolved from single-celled strcutures and may represent an elaboration of the actual use of the steam bath (*ibid*.: 163). These structures are discussed further in Chapter 6.

Burnt mounds in England and Wales

Burnt mounds have been recognised in England since the early twentieth century. This began with investigations by Cantrill (1911) and Bullows (1927), followed by more scientific excavations in the New Forest by Pasmore and Pallister (1967). Burnt mound research did not gather momentum until the late 1980s when Michael Nixon, an amateur archaeologist, brought these sites to the attention of Barfield and Hodder through his fieldwork in Birmingham and the West Midlands (Nixon 1990). This led to the excavation of a burnt mound at Cob Lane, Birmingham (Figure 3.7), which produced a Bronze Age radiocarbon date (Barfield and Hodder 1987). Their findings led to an interpretation of burnt mound sites as possible saunas and was the first to seriously question the traditional cooking site theory.

Investigations at Cob Lane eventually led to more intensive field survey in the south Birmingham area, where burnt mound sites occur at intervals of about 2km (Barfield and Hodder 1980: 198). A survey undertaken suggested that there were 23 sites in 22 miles of stream walked (Hodder 1990: 108). Burnt mounds have also been recognised in Northumberland (Cowley 1991; 2011) and Cumbria in the north (Heawood and Huckerby 2002; Hodgson 2007), Shropshire, Staffordshire, Warwickshire and Birmingham in the West Midlands and Leicestershire in the East Midlands (Barfield and Hodder 1987; Hodder 1991; Nixon 1990). Mounds composed primarily of burnt flint are particularly numerous in East Anglia with sites discovered in Norfolk (Crowson 2004) and Suffolk, and further south in Wiltshire, Dorset, Hampshire and the Isle of Wight (Topping 2011). A field-walking survey in the Wissey Embayment area carried out in the 1980s and 1990s by the Fenland Project (Hall and Coles 1994) identified more than 300 burnt stone sites. Burnt mounds have also been identified in several unexpected places, such as Phoenix Wharf close to Tower Bridge on the Thames (Moore *et al.* 2003). With the exception of East Anglia, it seems that the densities are much less than those in some areas of Scotland. The English Heritage National Inventory currently holds records for 913 burnt mounds in England (Arch Search 2012).

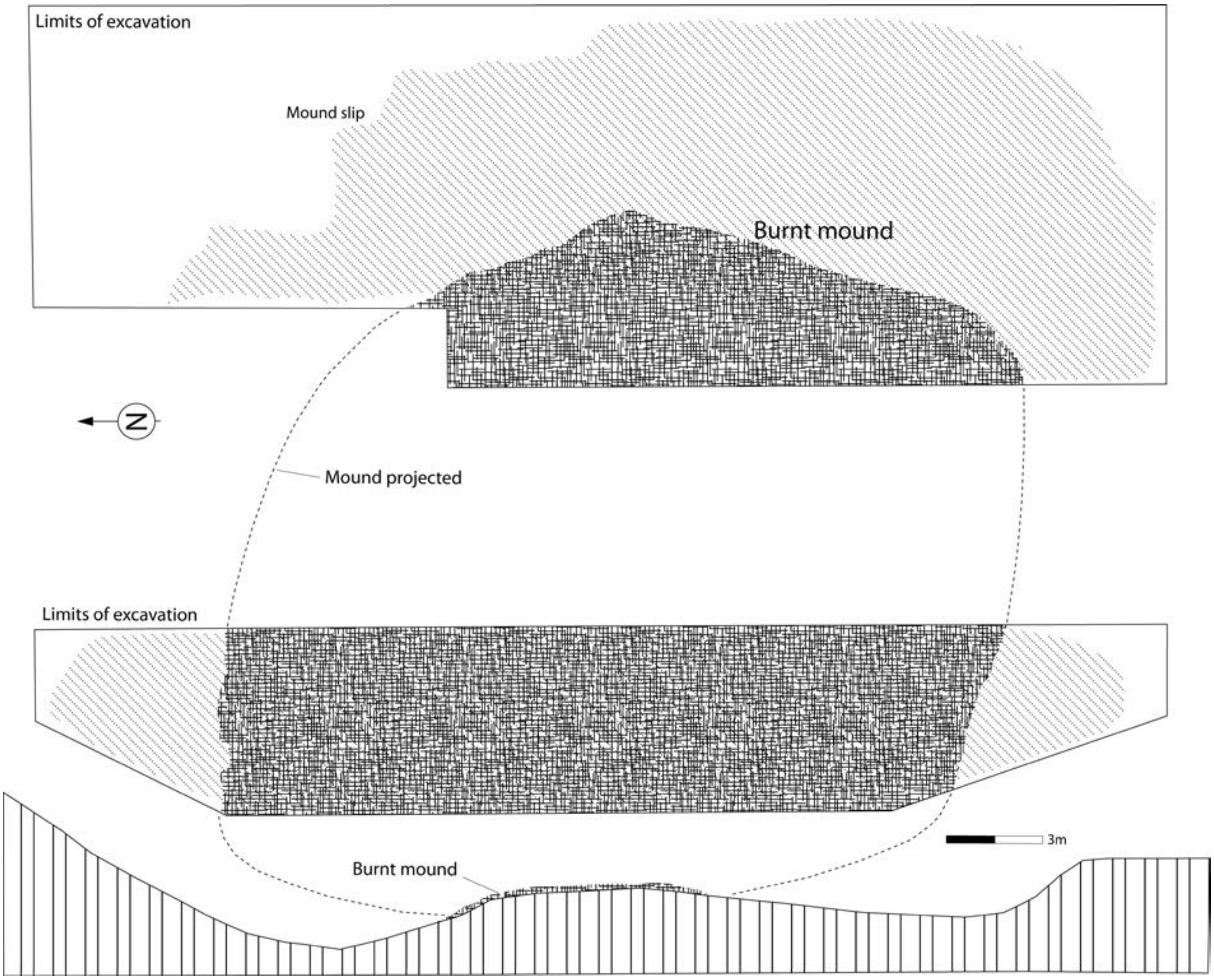

Figure 3.7. Plan and section of burnt mound at Cob Lane Park, Birmingham. Source: redrawn after Hodder 1990: 107.

Burnt mounds have long been recognised in Wales, especially in the south-west region. Cantrill and Jones recorded 271 sites as part of a geological survey conducted in the early part of the twentieth century (Cantril and Jones 1906; 1911). The Royal Commission on the Ancient and Historical Monuments of Wales currently holds records of 187 such sites in Wales.

During the 1970's, burnt mounds were essentially viewed as a new site type in Wales (White 1977). As with the rest of Britain and Ireland, levelled burnt mound sites were recorded in the course of a gas networks and road development (Figure 3.8). Investigations along the route of the Rhosgoch to Stanlow Shell Oil pipeline (mostly in Anglesey) uncovered seven burnt mound sites (White 1977), while archaeological monitoring in advance of the Cardigan-Aberystwyth trunk road recorded four sites (Williams 1985). A number of other excavations have taken place, notably the site at Graeanog (Kelly 1990) and at two mounds at Carne, near Fishguard, one of which produced evidence of a possible structure (Williams 1990). Sites have also been investigated by the Dyfed Archaeological Trust, with Williams (*ibid*.: 137) concluding that two distinct types of burnt mound may be connected to different functions and date ranges. Some of the mounds investigated by the Dyfed Archaeological Trust were associated with permanent settlement such as Stackpole and Dan-y-Coed, while others 'may represent activity peripheral to the main settlement pattern, this being suggested by their occurance on marginal land and by the lack of associated settlement evidence' (*ibid.*: 137).

Recent investigations have recorded several burnt mounds in Snowdonia National Park in North Wales (Fairburn 2001; Kelly 1992). In 2008, a wooden trough was exposed by erosion on a beach cliff on the tip of the Lleyn Peninsula (Pitts 2009). Excavations by the Gwynedd Archaeological Trust found that the trough 'was made of separate slabs of oak on the sides and base, held in place and sealed at the corners by shaped stakes' (*ibid.*). A timber channel extended from the wooden trough would have transported water from the stream to the pit. Although these features are commonly associated with Irish burnt mounds, this example seems to be unique in the Welsh archaeological record.

Further infrastructural development in recent years has added significantly to the number of burnt mounds in Wales (Cutler *et al.* 2012).

Figure 3.8. aerial view of burnt mound at Site 511, Pembrokeshire, looking north-east. wooden trough and stone hearth in central foreground. Source: © Cotswold Archaeology.

Excavations in advance of the A55 Anglesey road scheme uncovered 42 previously unknown sites, twelve of which were excavated and dated to the Bronze Age. A small rectangular structure was uncovered 25m north-west of a Middle Bronze Age burnt mound at Cefn Cwmwd. Although the structure was not scientifically dated, its spatial association may infer some relationship associated with pyrolithic technology. Sixteen spreads of burnt mound material were revealed in advance of an industrial estate at Llandygai, near Bangor in North Wales (Kenny 2008). Most of these had at least one associated pit or trough and the majority were situated on low-lying, boggy ground (*ibid*.: 52).

Dating of British burnt mounds

Artefacts are rarely recovered in British burnt mounds. Where they do occur, finds generally consist of flint or fragments of prehistoric pottery (Ladle and Woodward 2003; Brossler *et al.* 2004; Crowson 2004; Ripper and Beamish 2012). Pottery is occasionally recovered but does not seem to be closely connected to the use of these sites. An exception is Tangwick, Shetland, where fragments showed damage consistent with immersion in hot water (Moore and Wilson 1999).

Radiocarbon dating is the most widely used technique to date sites in Britian, with more limited use of techniques such as thermoluminesence (Anthony 2001; 2003). The range of dates from published sites extends from the mid-third millennium BC to the mid-first millennium BC. Ó Néill's (2009: 40) analysis of forty-one radiocarbon dates from burnt mounds in Scotland suggests a possible beginning of the tradition in the early to mid-fourth millennium BC. This is supported by a recent assessment of 87 dates from Scotland (Beamish 2009). Only one site, Greenlaw in Dumfries and Galloway, is dated to this period, consisting of a single pit filled with heat-shattered stone (Maynard 1993; Kenny 2008: 67). A site at Kirkhill Farm in southern Scotland has produced some of the oldest burnt stone deposits, with dates ranging from 3000–2600 BC (Anthony 2003: 63). Anthony's study of burnt mounds in Orkney and Shetland indicates dates ranging from the Late Neolithic through to the first century AD. A burnt mound at Kilmartin, in south-west Scotland is dated by thermoluminescence to 2800–2400 BC (Anthony *et al.* 2001). Barber (1990) noted there is no record of burnt stones at Neolithic settlements such as Skara Brae or the Links of Notland. He suggested that in Scotland the first extensive use of hot stones for water-boiling may only have developed in the Bronze Age. That said, Middle Neolithic dates were returned from two burnt stone spreads at Parc Bryn Cegin, near Bangor in north Wales. Similarly, a series of isolated pits containing burnt stone dated 4220–3790 BC at Cefn Du, Gaerwen, are interpreted as probable 'pot boilers' (Cutler *et al.* 2012). The dating evidence from other Welsh, English and Scandinavian burnt mounds indicates this tradition began during the early

third millennium BC, contemporary with the widespread adoption of the technology in Ireland (Ó Néill 2009: 40; Topping 2011: 3; Beamish and Ripper 2012: 198).

Like Ireland, it has been suggested that burnt mounds in Britain continued to be used into the historic period. A site at Kilearnan Hill, in the north of Scotland, produced a number of Bronze Age dates, while a date of AD 1300–1490 was obtained from an area of burning at the top of the mound (Anthony 2003: 91). This would appear to represent secondary activity unrelated to pyrolithic processes. A date of AD 680–980 from a burnt mound at Kirkhill farm in Dumfries and Galloway is considered unreliable as it is the only medieval date from a site that has produced several prehistoric dates (Ó Néill 2009: 241). Partial excavation of a mound of burnt stone in Morfa Mawr, south-west Wales, produced an early medieval radiocarbon date (Williams 1990: 134). No water trough or hearth was revealed at this site, so it cannot be considered a burnt mound (Brindley *et al.* 1989–90: 30). A charcoal sample from a burnt mound at Holyrood, on Anglesey produced a date of AD 560‒780. This is situated close to a medieval well so the date may relate to secondary activity (Maynard 2012: 129). The site of Auld Taggart 4, East Rhine, is the only burnt mound site in Britain to produce reasonably conclusive evidence of a medieval practice of water-boiling similar to prehistoric site types (Russell-White 1990: 75). The site consisted of a low mound of burnt stone that overlay an unlined pit. Three medieval dates were obtained from a possible hearth area and from the body of the mound material. An adjacent burnt mound (Auld Taggart 2) is also dated to the early medieval period (*ibid.*: 74).

Based on current information, the dating evidence from British burnt mounds suggest an origin in the Late Neolithic period, sometime after it was first used in Ireland (see Chapter 9). It is difficult to assess the significance of the Middle Neolithic dates at Greenlaw in Dumfries and Galloway and Parc Bryn Cegin, near Bangor in north Wales as these represent the only possible Early Neolithic burnt mounds in Britain. Maynard (1993: 35) suggests that the site at Greenlaw has an unusual location for a burnt mound and the radiocarbon date may be connected to earlier activity. Although earlier Neolithic dates have been recovered from pits filled with burnt stone and charcoal with no associated mound , dates from burnt mounds where a spread or mound is an integral part of the evidence appear to span a broadly continuous sequence that starts with a date of 2860–2400 BC from Kilmartin, Argyll (Anthony *et al.* 2001: 924).

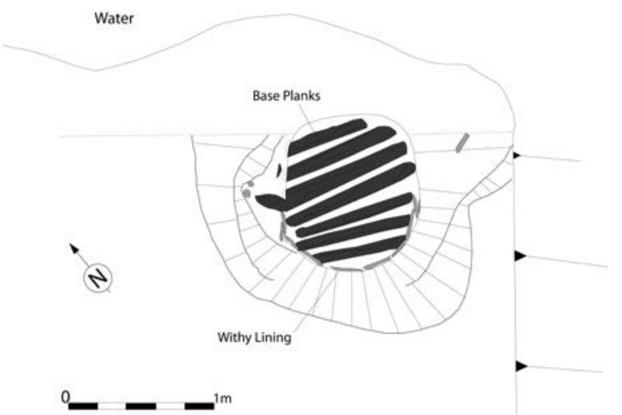

Figure 3.9. Pit with plank and withy lining at Swales Fen, Suffolk. Source: Redrawn from Martin 1988: 359.

Functional debates in Britain

The purpose of burnt mound sites has long been debated in Britain. An association with cooking has been popular due to the historical references of the term *fulacht fia* or *fulacht fian* (cooking places of the wild/of the deer of the *Fianna*) in Ireland. Other interpretations have been linked to the British burnt mound tradition, such as saunas/sweatlodges (Barfield and Hodder 1987), textile-fulling (Jeffrey 1991), leather shield manufacture (Coles 1979), or cloth washing or dyeing (Lucas 1965) and beer brewing (Gustawsson 1949), as well as possible associations with metal processing (Thelin 2007).

As mentioned previously, the lack of cooking debris, such as animal bone in burnt mound deposits is usually explained by acidic soil conditions. Whilst this may genuinely be the case at a number of sites, total sieving of the burnt mound material at Cobb Lane in Birmingham produced no animal bone in soil that had a neutral pH (Barfield and Hodder 1987). Furthermore, excavations at Crawford in Scotland (Banks 1999) revealed bone at a wide variety of sites in the vicinity of two burnt mounds, yet none in the mound deposits. It should be noted that an absence of animal bone does not preclude a cooking function for these sites as the meat in question may have been butchered and/or consumed elsewhere.

Recent excavations in the East Midlands identified the presence of butchered animal bone on site. A burnt mound located on a palaeochannel of the river Trent at Castle Donington, Leicestershire, produced animal bone from the trough and the ancient water channel, with one particular cattle femur showing marks associated with skinning (Beamish and Ripper 2003: 37). A burnt mound at Willington, Derbyshire, on the edge of a silted palaeochannel contained bone fragments of ox or horse, one of which may have been butchered. A substantial timber-lined trough was uncovered at this site made of whole and split birch and alder logs. A circular, plank and wattle-lined trough excavated in Suffolk (Martin 1988: 359) contained the vertebra of a large mammal (deer or cow) and a long bone fragment, vertebra and pelvic bone of a smaller mammal (Figure 3.9).

The argument that these burnt mounds were seasonal hunting camps has not gathered much credence in Britain, particularly given the density of sites in some areas. Hunter's (1996: 61) study of burnt mounds on Fair Isle,

Shetlands, suggests it would be difficult to explain the burnt mounds as being anything other than component elements of a larger settlement infrastructure. It seems unlikely that burnt mounds would have been a focal area within settlements, as one would expect a greater occurrence of domestic material culture. An alternative to the settlement theory is that burnt mounds were located on the periphery of settlements. In that instance, the absence of cooking debris is less problematic. Barber (1990) notes that in such situations, butchery and eating may have taken place elsewhere within the settlement complex, a point that has also been made in Ireland (Waddell 2000).

The relationship of burnt mounds to settlements has not been fully established. The topographical location of many examples on low-lying areas of potentially good land implies that they were sited not far from contemporary settlements. In certain instances, burnt mounds have been identified during the excavation of settlement sites, such as at Blairhall Burn, Dumfries and Galloway, where domestic roundhouses identified within 100m of burnt mounds are all dated to 1700–1000 BC. One of the largest burnt mounds in Britain was excavated adjacent to a large settlement site of Middle to Late Bronze Age date at Reading Business Park, Berkshire (Brossler *et al.* 2004). Hedges (1984: 26) considered this issue in relation to two forms of Bronze Age settlement in Shetland, namely a continuation of the oval house tradition, and burnt mounds that appear at the beginning of the Bronze Age taken to individually indicate the location of dwelling houses. He does not suggest that all burnt mounds indicate permanent settlement, the site of Tougs being the exception, which he concluded was too small for an all purpose domestic structure and could instead relate to an open-air communal cooking facility. Excavations at Tougs, Burra Isle on Shetland, uncovered a rectangular building wedged between the southern extremity of the burnt mound (Hedges 1986: 27). Hedges concludes that this example is a cooking shelter and certainly not a house (*ibid.*: 27).

A weakness in the argument that many burnt mounds in the Northern Isles represent settlement sites is the position of the site at a local level. The location of these sites suggests that many of them occur at places that would have been unfavourable for domestic occupation (Dockrill *et al.* 1998: 62). The stone structural components associated with the burnt mound deposits in the Scottish Isles suggested that the troughs were enclosed within buildings, raising the possibility of a sweatlodge or sauna inteprretation. This theory gained momentum after excavations at Cobb Lane in Birmingham, where the absence of cooking waste led the authors to suggest the site may have functioned as a sauna (Barfield and Hodder 1987).

The structure at Meur, Sanday, showed no evidence of being roofed (Toolis 2005: 42). The walls that defined the burnt mound structure at Meur were single vertical slabs no more than 1m high, unlikely to have supported a roof (*ibid.*: 42). The burnt mound at Liddle, however, seemed to have two walls associated with its use. The primary wall and the outer wall. The latter was interpreted as a flimsy wall with a maximum height of 0.35m and was designed to confine the encroachment of the burnt mound material (Hedges 1977: 45). If these two walls are indeed contemporary, then one may have separated the burnt mound material from the trough and the inner working area, while the other may have supported a roof, if the structure at Liddle is interpreted as a building. Moore and Wilson suggest that the manner in which the interior of Tangwick is divided and defined with entrance portals and small cells, is best understood as elements within a roofed building (Moore and Wilson 1999: 228). It is possible that turf was used as a roofing material in these structures. Investigations of a partially waterlogged Neolithic site at Eilean Domhnuill North Uist has indicated that turves may have formed the superstructures of buildings based on stone foundations (Mills *et al.* 2004: 893). Interestingly, initial stripping of turf prior to burnt mound activity was seen at Sparrowmire Farm, Kendal, (Heawood and Huckerby 2002: 45) and at Derryville Bog, Ireland (Cross May *et al.* 2005). Toolis (2005: 43), however, rules out the possibility that the burnt mound at Meur was a roofed building given the limited height and narrow width of the orthostatic walls.

It may be the case that some of these sites were open-air cooking facilities where the enclosing wall functioned as a revetment for the accumulation of burnt stone similar to examples in Ireland (see Chapter 4). Moore and Wilson (1999: 232) state that the presence of kerbing at Tangwick and other sites indicates that a degree of planning was involved in the construction and management of burnt mounds. These mounds may have been deliberately deposited in such a way that would have provided shelter to the working area. Whether or not the enclosing element suggest a building, what seems important is the purpose intended within and around the working area. This space was clearly planned, maintained and free from burnt stone. Where there is evidence that structures have not been systematically cleaned out after use, then it can be argued that the enclosing element was not a revetment and may have been roofed instead.

Other structures in these sites may be more closely tied to activities other than the cooking of food (Maynard 2012: 126). For instance, a small structure associated with burnt mound material was identified at Site A at Stackpole Warren, Wales. The author suggests that the building and the presence of burnt stone debris may point to a sweating function due to the occurance of a raised platform in the centre of the building (Williams 1990: 137). At site C2/3 Cefn Cwmwd, Anglesey, a rectangular structure defined by a gully was located 25m north-west of a Bronze Age burnt mound (Maynard 2012). The structure has not been dated, however the spatial association of both sites may infer some relationship (Figure 3.10). Other examples include the burnt mound at Ceann nan Clachan, North Uist, formed around a small, sub-oval structure that lacked the usual indicators of domestic activity (Armit and Braby 2002: 229). The authors suggested that two forms of sweatlodges could be deduced from the archaeological

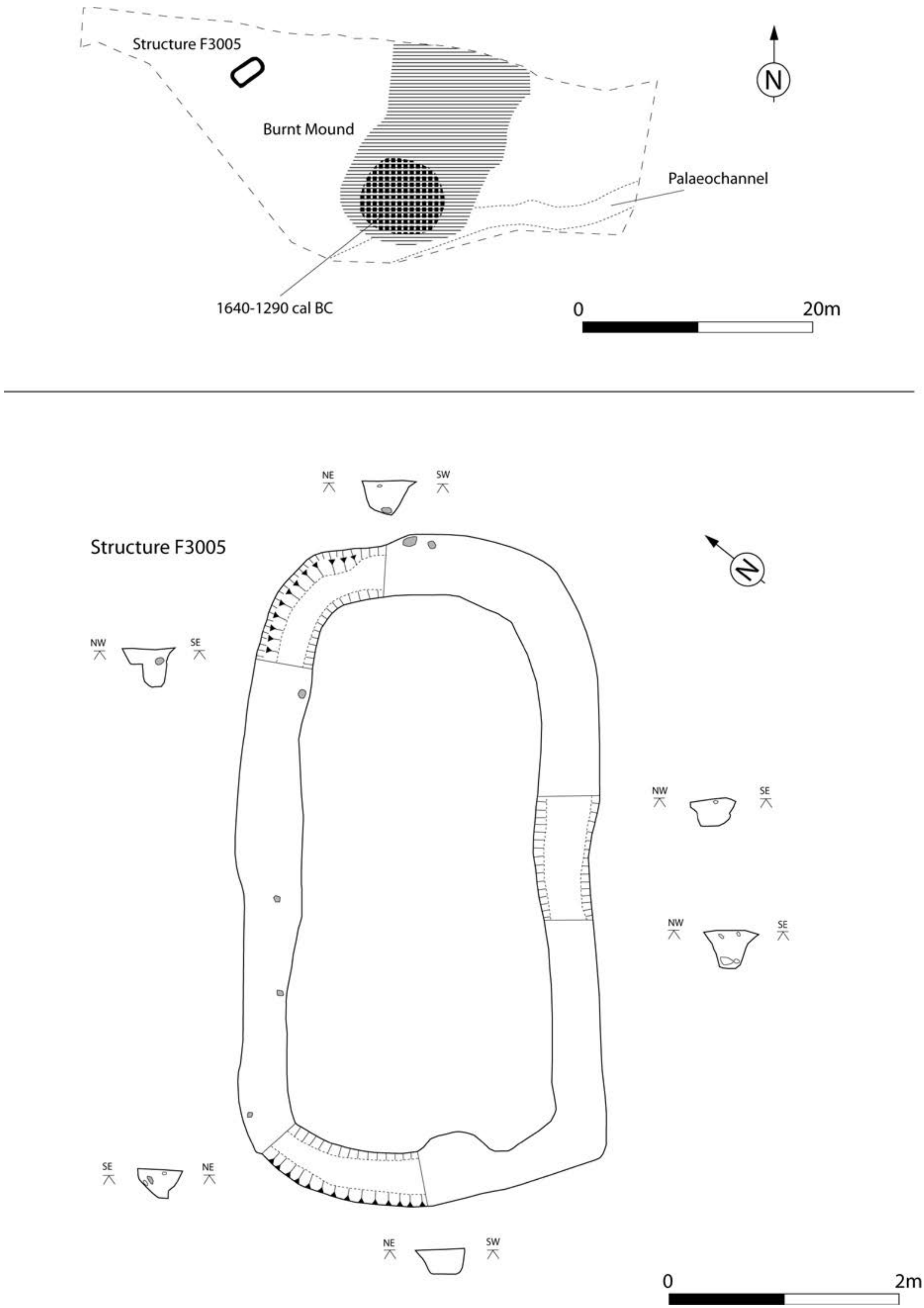

Figure 3.10. Burnt mound C2/3 and structure F3005, Cefn Cwmwd, Wales. Excavated along the A55 Road Scheme. Source: Redrawn after Maynard 2012: 127.

evidence. They proposed that the evidence from structure one indicates a sweating function using steam, while the second structure on the site differs due to a recessed hearth in the south west cell. Because of the presence of the 'fire-box' in the middle cell, the authors suggested two forms of sweatlodge. This design was also noted at a Preclassic Maya sweatbath at Cuello, Belize, where the fire box generated heat for a small enclosed chamber, while an external flue drew smoke from the fire out to the rear of the building (Hammond and Bauer 2001: 683).

Parallels can be drawn with these sites and Bronze Age structures in Ireland. A recessed hearth structure was recorded at Site D in the Barrees Valley, Co. Cork (O'Brien 2009). Inside the floor of the structure was a box feature interpreted as the remains of a possible oven. Therefore, the structure could have had a specialised function associated with cooking. Similar structures have been recorded at Drombeg, Co. Cork (Figure 3.11), Valentia Island, Co. Kerry and Garranes in the Beara Peninsula (O'Brien 2012a). However, the latter structure did not produce clear evidence of an internal oven. It is possible that these were specialised structures for purposes other than living spaces (Figure 3.12). Ovrevik, for example, in his discussion on similar structures in Shetland states that the 'small available floor space in the buildings, suggests that they were not buildings but possibly cook-houses for a small community (Ovrevik 1990: 148).

Environmental evidence from Meur, Sanday indicated that the immediate environment of the burnt mound was not cultivated arable land but grassland with cultivated crops at some distance away (Toolis 2005: 44). If this is correct, it suggests that the burnt mound was at some distance from settlement areas. Toolis states that 'this separateness from contemporary settlements may also accord with the specialised role for burnt mounds and suggests that cooking here perhaps took place within a cycle of transferred obligations between landholding units that made the best use of the limited resources' (Toolis 2005: 44).

This may also suggest occasional ritual or ceremonial use of pyrolithic technology. Water-boiling locations may have served a variety of needs and their social role may have extended to providing a venue for celebrations to mark particular events. For instance, a burnt mound at Bestwall, Dorset, was associated with the demolition and abandonment of a roundhouse. The deposition of a large assemblage of Deverel-Rimbury pottery, with two copper-alloy bracelets, together with the use of pyrolithic technology for feasting, may have been used to mark the end of the use history of the house (Ladle and Woodward 2003). A Late Bronze Age burnt mound at Camden Hill Road, London, produced two pits and a series of post-holes along with burnt flints. A prehistoric vessel found in one of the pits may have been deliberatly placed, as part of a closing event (Moore *et al.* 2003: 179). A ceremonial or ritual aspect associated with pyrolithic technology has also been recorded at Feltwall Anchor, Norfolk, where human remains were recovered from the burnt mound, while in South Wales burnt mound material was deliberately deposited around a standing stone (Crowson 2004: 34).

3.3 PREHISTORIC BURNT MOUNDS IN NORTHERN EUROPE

Elsewhere in Europe, pyrolithic deposits have been recorded in the Atlantic region dating to the Upper Palaeolithic period (see page 33). The technology has also been recognised in the French Neolithic at sites such as Caliraux a Cubord, Charavines, Vinelz and Verdon (Strahm 1972–1973; Furger 1980; Ramseyer 1980; Pétrequin 1984; Pautreau and Funtugne 1996). Ó Néill (2009: 46) notes the occurrence of *splittersteinhügel* (heap of shattered stones) in Germany, a term that does not seem to have great currency. In Switzerland, the term four de terre (polynésien) is often used to describe types of earth ovens using a pyrolithic technology (Ramseyer 1991). These consist of rectangular pits, reddened by fire and filled with deposits of fire-cracked rock, some of which contain food waste (Figure 3.14). They are dated to the Late Bronze Age and Early Iron Age periods (Ramseyer 1991: 83). Similar pit features have been recorded in sub-Arctic Norway, lined with slabs and associated with fire-cracked rock. Lipid analysis has concluded that these pits were used to extract oil from the blubber of marine mammals during the medieval period (Larsson 1986; Heron *et al.* 2010).

Elsewhere, the prehistoric burnt mound phenomenon is found elsewhere in eastern areas of central Sweden, such as Södermanland, Västmanland, Östergötland, and Småland (Hyenstrand 1968). It has been suggested (Larsson 1986: 151; Larsson 1990: 142) that the concentrations of burnt mounds in these areas is associated with a belt of migmatised quartz-diorite (mainly gneiss and gneiss-granite), as the pure granites covering much of southern Sweden are perhaps more resistant to heating. These geological features may explain the absense of recorded burnt mounds in other parts of the country. Larsson roughly estimated that 6000 examples are recorded in Sweden with occasional examples found in neighbouring countries such as Norway, Denmark and Finland. The term *skärvstenshögar* is used to describe these sites, meaning a mound or heap consisting of fire-cracked stones (Figure 3.13) and charcoal (Larsson 1990). They usually appear in clusters of three to seven mounds over area of 500–1000 square metres (Larsson 1986: 338). Morphologically, the mounds have been sub-divided into a number of different types including those with 'wall-formed' mounds composed of a low walls of fire-cracked stones, circular or oval in shape, ranging in size from 3–10m. The more typical examples are circular or oval forms, usually 3–15m in diameter and 0.3–2.5m high (Larsson 1990: 148). A fourth type occurs quite commonly, where the burnt mound accumulates around a large boulder in a deliberate manner. The use of radiocarbon and thermoluminescence techniques in the 1980s revealed a broad date range for *skärvstenshögar* between 1600 BC and AD 500 (*ibid.*).

Figure 3.11. Drombeg revetment structure surrounding boiling trough and hearth. Source: Alan Hawkes.

Figure 3.12. View of Garranes burnt mound during excavation. Phase II structure possibly associated with dry roasting. Source: William O'brien, UCC.

Although initially suggested as being similar to those in Western Europe, it is now understood that the Scandinavian mounds of fire-cracked stone cannot be related to Irish and British examples due to the absence of troughs and clear evidence of water boiling, as well as the material found within the mounds themselves (Brindley *et al.* 1989–90: 25). The latter includes domestic waste such as pottery, burnt clay, grinding stones, burnt animal bone and occasional finds of casting moulds and crucibles (Larsson 1990: 144). Early studies suggested a possible connection with rock carvings due to the spatial association of many sites in eastern Östergötland (Nordén 1925). Subsequent field survey indicates that burnt mounds have a much wider distribution than rock art, which is mostly located in more peripheral parts of the province (Larsson 1986: 150). More interestingly is the apparent association of burnt mounds with contemporary structures (Jaanusson 1981; Tesch 1983) leading to the general assumption that *skärvstenshögar* represent the waste debris from settlement sites of the Bronze Age (Larsson 1986; 1989; 1990). Settlement context suggest that skärvstenshögar may be regarded as refuse dumps located 10–30m away from contemporary houses (*ibid.*). This is suggested by the presence of Late Bronze Age burnt mounds at a number of contemporary settlement sites in the provinces of Södermanland, Uppland and Västmanland (Schönbäck 1959; Rentzhog 1967; Hyenstrand 1968; Wigren 1984). Furthermore, burnt mounds were recorded at the settlement site of Hammand Church in Denmark (Boas 1991).

Site functions have not dominated the burnt mound discussion in Scandinavia as in the case in Britain and Ireland. In the early twentieth century, Swedish burnt stone deposits were related to 'bonfires' associated with rock carvings. A pyrolithic water-boiling technology was recognised by the late 1940s, with Gustawsson (1949) suggesting a relationship with beer manufacturing. This would later be broadened to encompass all types of heating with other industrial processes suggested, particularly as traces of bronze and iron production had been found in connection with deposits of fire-cracked stone (Janzon 1984). Larsson (1986: 150) observed that the overall distribution may be taken to indicate a broader settlement pattern, with some mounds relating to specialised craft activities and other processes.

As mentioned previously, a number of early burnt mound excavations in Sweden recorded circular stone settings under burnt stone deposits. These possibly represent the remains of temporary structures, or may delimit an area in which certain activities took place (Ó Néill 2009: 161). The deposition of mounds of burnt stone around boulders is common and seems to have been a deliberate act, leading Ó Néill to make a comparison with *Brandopferplätze* or burnt offering places found in Central Europe. These sites consist of domestic rubbish, animal bone, some burnt stone and other objects deliberately deposited around boulders, and occasionally other structures between 1800 BC and AD 200 (*ibid.*: 162; Weiss 1997).

The ceremonial and ritual associations of skärvstenshögar has also been considered. A possible structure associated with burnt mounds at Ringeby in Sweden has been described as a cult house, located close to a boulder where various offerings were made. There are parallels for this site elsewhere in Scandinavia and Central Europe (Stråbom 1994). The presence of human remains in some burnt mounds may indicate ritual associations with pyrolithic technology. Of 98 burnt mounds examined in the region north of Lake Mälaren, 19 contained human bones (Sara-Noge 2009). Excluding mounds without osteological analyses, 32% of the mounds contained human bone and about half of the mounds with human bones had internal stone circles or kerbs, while only about a quarter of those without human bones did. A central boulder was the most common structural detail in mounds without human bones. There is also a tendency that most of the human bone deposits were made during the Late Bronze Age, and were deposited during, or soon after the deposition of each mound (*ibid.*). Cooking pits have also been discovered in Norway in close association with cremation burials. Oestigaard (2000) refers to roasting pits in association with cremation burials that contain nothing but fire-cracked stones. He also refers to a grave mound excavated in 1973 where slightly burnt bones with cut marks were found in a cooking pit, or sunken hearth, in which stones were heated for cooking and roasting (*ibid.*: 47). Sara-Noge (2009) suggests that burnt mounds can no longer be interpreted simply as piles of rubbish and that their contents and construction point to a more ritual interpretation. Ó Néill (2009: 185) suggests that the burnt mounds associated with stone settings, the human remains found in some sites and the ritual complex at Ringeby present a picture that is completely different from that at Irish and British burnt mounds. Furthermore, while the fire-cracked stone may relate to pyrolithic process at these sites, some may originate as actual offerings similar to the brandopferplätze tradition in Central Europe (*ibid.*: 185).

Burnt stone deposits have also been reported in Denmark (Thrane 1975; Larsson 1986), where the technology has received little attention. Discrete mounds of heat-shattered stone with associated boiling receptacles are absent from the archaeological record, although radiocarbon analysis has demonstrated that a pyrolithic technology was practiced during the Bronze Age (Berglund 1982). In East Jutland, a number of Middle Bronze Age wells contained burnt stone (Boas 1983), while at Krikebjerget, a layer of Bronze Age 'cultural material' (including burnt stone) overlay ninety-three pits (Berglund 1982; Ó Néill 2009: 23). Heat-affected stone has also been recovered in small amounts inside Bronze Age structures, such as at Thy, Denmark. These deposits were associated with hearths and were probably used for small-scale cooking within the house (Earle *et al.* 1998).

Two excavated burnt mound sites are known from Norway (Løken 1987; Øystein 1980), but this does not seem to have been a widespread phenomenon in that region (Ó Néill 2009: 23). A pyrolithic technology was used to extract oil

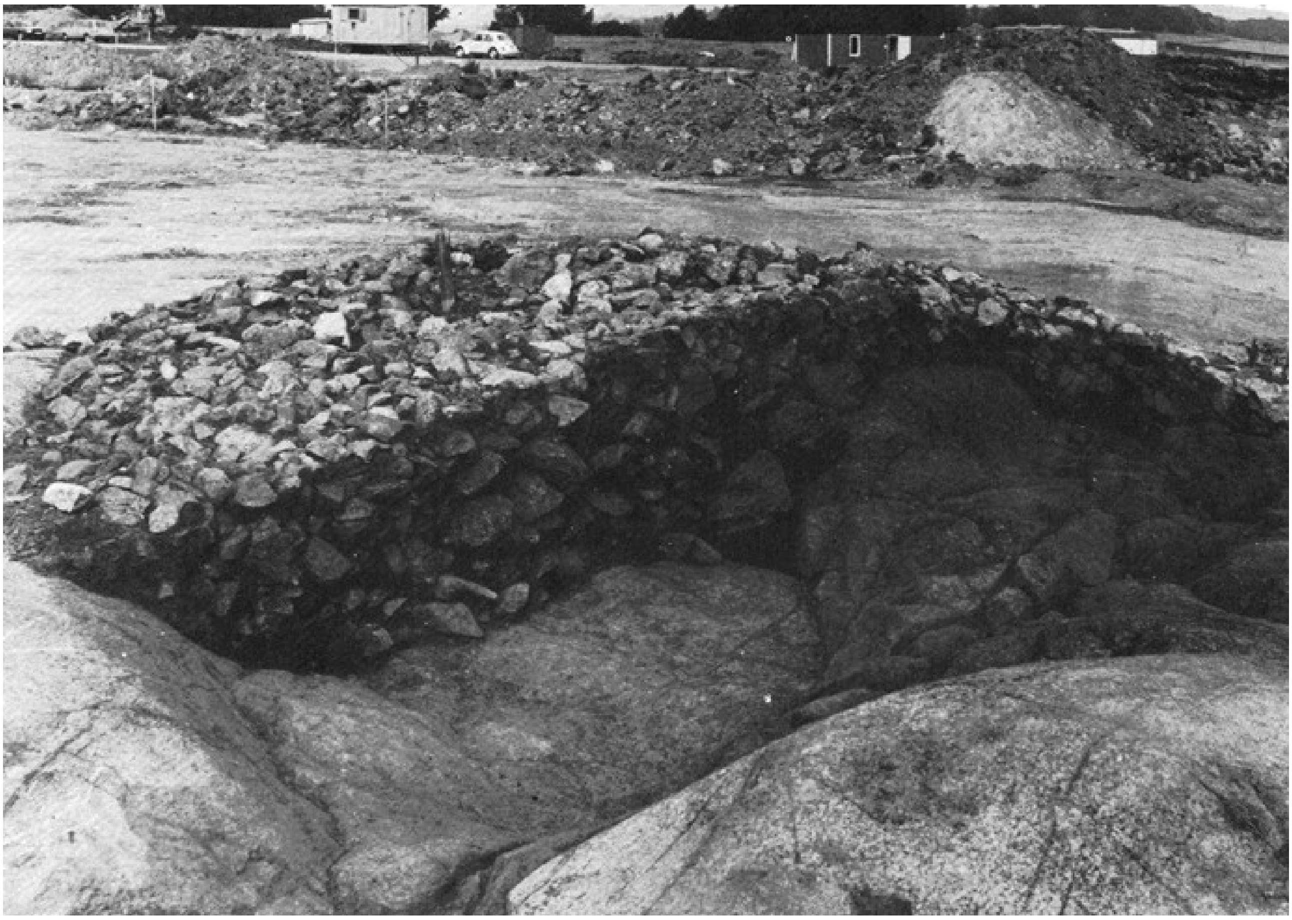

FIGURE 3.13. A BURNT MOUND (*SKÄRVSTENSHÖGAR* IN SWEDISH) FROM THE PROVINCE OF ÖSTERGÖTLAND DURING EXCAVATION. SOURCE: LARSSON 1990:51.

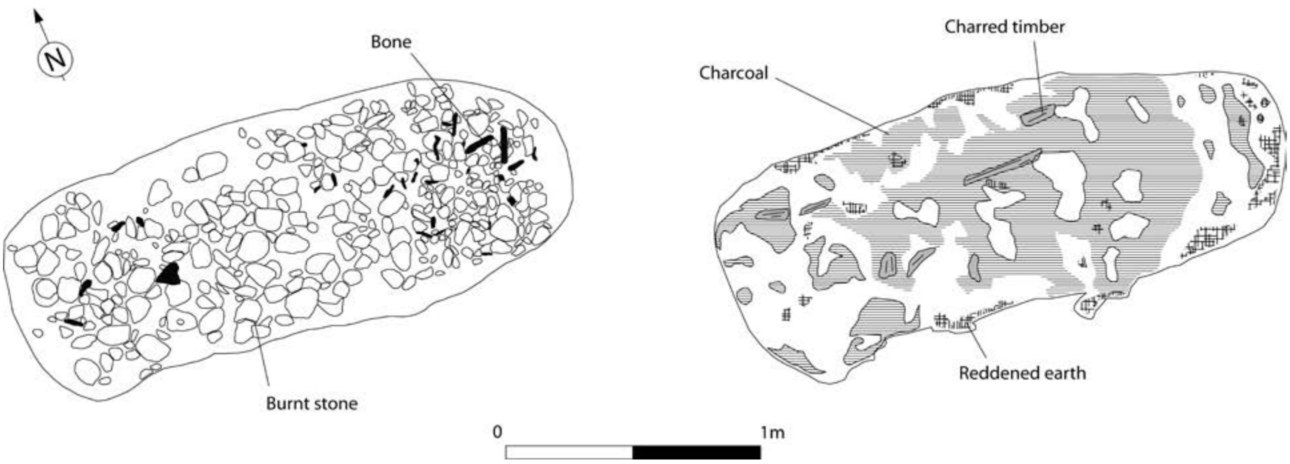

FIGURE 3.14. CHATILLION-SUR-GLANE (POSIEUX), FRANCE. UPPER LEVEL OF BURNT STONES AND BONE (LEFT) AND LOWER LEVEL WITH CHARCOAL, CHARRED TIMBER AND OXIDIZED EARTH (RIGHT). SOURCE: ADAPTED FROM RAMSEYER 1991:71.

from marine mammal blubber in some sites in northern Norway and these have been dated to the Iron Age and Medieval periods (Larsson 1986; Heron *et al.* 2010).

These burnt mound deposits in Scandinavia are not directly comparable to the Irish and British examples, where particular environmental settings were used for pyrolithic water-boiling and other processes. The evidence from the rest of continental Europe also cannot be compared to Ireland and Britain, with only features such as earth ovens identified in some parts of Germany, Austria, Switzerland and Italy (Ó Néill 2009: 24). These features employed a pyrolithic technology for dry roasting and were first noted in Ireland at burnt mounds such Ballyvourney and Drombeg, Co. Cork (O'Kelly 1954; Fahy 1960) as above-ground stone-lined structures. They have subsequently been recorded at other locations such as Clare Island, Co. Mayo (Gosling *et al.* 2007) and the Barrees Valley, Co. Cork (O'Brien 2009). Earth ovens have also been identified at Parc Bryb Cegin, Llandygai in Wales dating to the Neolithic and Bronze Age periods (Flook and Kenny 2008). Pit ovens are frequently encountered in the archaeological record from the South Pacific (Orliac 1980), to North America (Stewart 1977), and, in Europe, dating from the early Neolithic (Ó Néill 2009) to the nineteenth century Scotland.

In conclusion, Ó Néill (2009: 130) observed that pits associated with burnt stone and intended for pyrolithic water-boiling are very rare in Scandinavia. Wood or stone-lined troughs of the Irish type are completely absent there. In total, nine pits are interpreted as being associated with pyrolithic deposits, seven of which occur in Denmark. This indicates considerable differences between the Scandinavian 'heaps of fire-cracked stone' and burnt mounds from Western Europe. British burnt mounds are the only pyrolithic sites in Europe to share the morphological characteristics of Irish examples, namely a trough, hearth and adjacent burnt mound.

3.4 PYROLITHIC TECHNOLOGY IN INDIGENOUS SOCIETIES

In the absence of diagnostic material culture and food waste, the interpretation of burnt mound deposits can often be difficult. As mentioned previously, the use of earth ovens was popular in Europe during the Iron Age (Ramseyer 1991), a practice which continued well into the medieval period. For instance, in Denmark, a rectangular pit found at the medieval village site of Store Valby, contained nothing but fire-cracked stone and charcoal (Lerche 1969). Earth ovens are still used in places such as Papua New Guinea (Steensberg 1980) to cook vegetables and meat wrapped up in leaves by roasting, steaming and baking (Büchsenschütz 1992). The cooking pit was always dug at the 'traditional spot' where the soil was mixed with charcoal from previous ceremonial feasts (Steensberg 1980: 194). On certain occasions, such as marriages or ritualised combats, earth ovens such as these are used for communal feasting. The technique is used for prolonged pit roasting, taking several hours to complete and is often protected from the rain with a make-shift shelter (Hurl 1990: 155). Archaeologically, all that remains from this process is a slightly charred pit, a hearth and a pile of fire-cracked stones (*ibid*).

Smith (2000) described six basic types of cook-stone facilities recorded in historic times in North America, versions of which were used by hunter-gatherers throughout the Northern Rockies and beyond. They include: (1) earth oven in a shallow pit with rocks heated therein; (2) earth oven in a shallow pit with rocks heated in a nearby hearth; (3) surface oven or hearth with rocks heated therein; (4) steaming pit with rocks heated in a nearby hearth; (5) stone boiling in a pit with rocks heated in a nearby hearth; and (6) stone boiling in above-ground containers with rocks heated in a nearby hearth.

Roasting pits/earth ovens

This method of cooking is also widely documented in many parts of the world (Steensberg 1980; Peacock 1998; Smith 2001; Thoms 2008; Wandsnider 1997), with ethnographic accounts supported by archaeological evidence Figure 3.15). The type of cooking generally involved an unlined pit in which hot stones are evenly distributed and covered by a layer of plant material that served as a base for the food produce. Additional layers of hot stones and plant material were then added, depending on the amount of food being cooked, before being covered by earth. A fire may also be lit on the surface of the covered pit, depending again on the food type (Figure 3.16). Alternatively, a fire is lit within the pit along with stones and allowed to die down before any food is added and covered over.

Steaming pits

Steaming pits would have functioned in a similar manner to earth ovens, the only difference being a small prepared hole in the earthen lid made by inserting a small stick into the pit prior to its filling. As the pit was covered over, the stick was removed. Water was then poured through the small aperture, which was sealed promptly to insure that steam and vapour did not escape. Thoms (2007; 2008; 2009) has written extensively on the use of hot rocks in western North America, where prolonged cooking is required to hydrolyse inulin-rich roots adequately, as well as to detoxify plant foods rendering them more readily digestible and nutritious.

Boiling pits

The origins of pyrolithic water-boiling is unclear, however at some early European sites fire-cracked stones may have been used as pot-boilers (Strahm 1972/3; Furger 1980; Batchelor 1979). The general absence of prehistoric pottery in excavated burnt mounds suggests that hot stones were not used for that purpose in those sites. It has been suggested that Bronze Age pots were generally not robust enough to survive this type of treatment (Seager-Thomas 2010).

Figure 3.15. Indian women place rocks on a fire to heat them for use in the earth oven. Painting by Charles Shaw. Source. texasbeyondhistory.net.

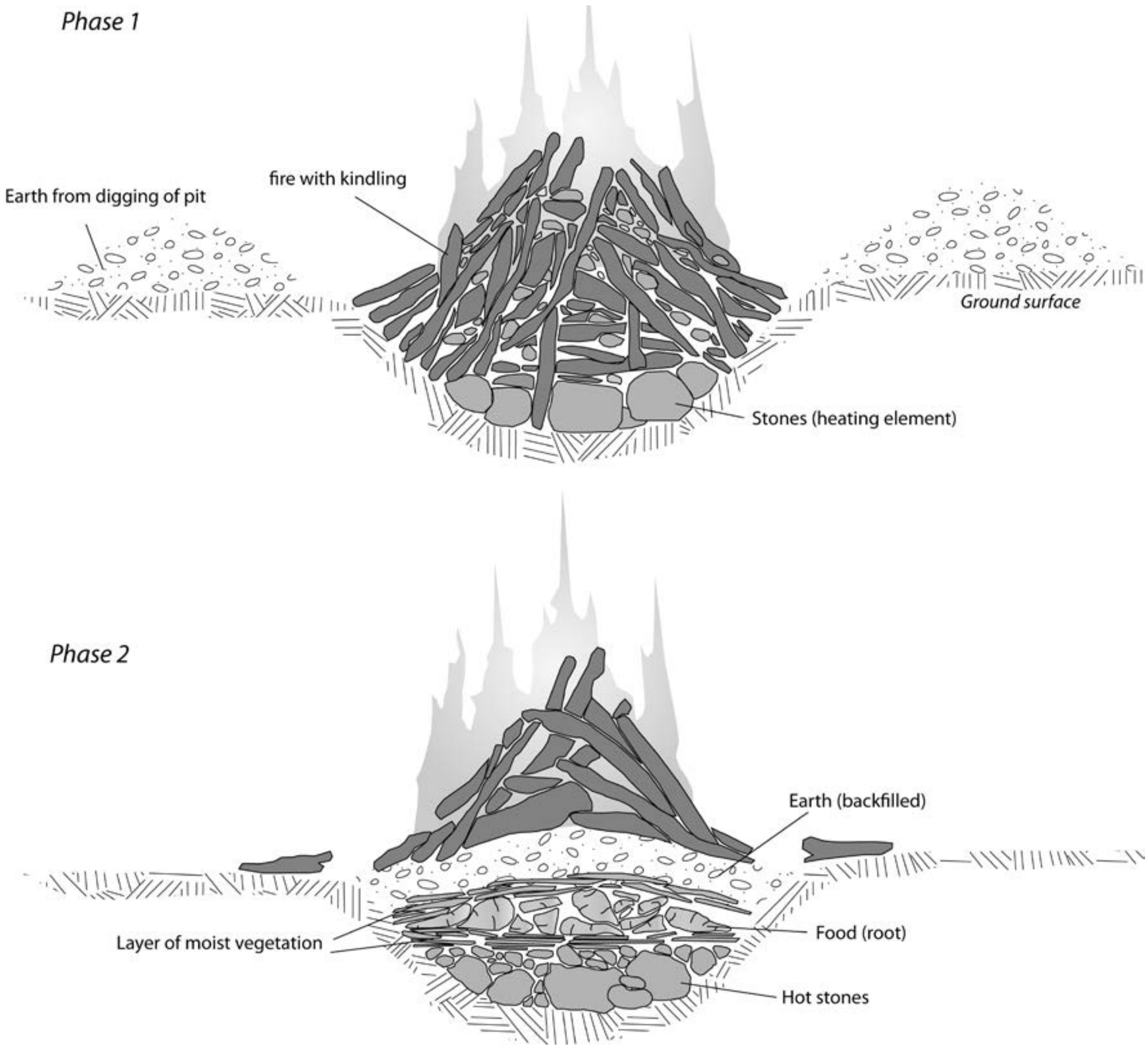

Figure 3.16. This figure outlines the operation of a typical earth oven. Phase 1 (above) invloves digging a pit and lighting a fire on a layer of stones until red hot. Phase 2 involves placing layer of moist vegetation and food produce into the pit and backfilling with soil. An additional fire on the closed pit helps to cook the food. Source: adapted from Peacock 2008:119.

Boiling was an important technique used to extract bone grease among Upper Palaeolithic hunter-gatherers in Europe (Nakazawa *et al.* 2009). It is suggested that shallow-basin hearths of late Upper Palaeolithic occupations in El Mirón Cave were the results of stone-boiling episodes, to extract grease from bones of ibex and red deer. Binford (1978: 157−163) records this process amongst the Nunamiut Eskimo where animal bone was pulverised into a dust before being boiled using heated stones in a wooden bucket. The grease was then skimmed off the top of the water. Stone boiling was also practiced by indigenous North American tribes such as the Kalispel (Hart 1976) for small family sized cooking, while large-scale boiling occurred when families aggregated during winter or for communal gathering activities (Thoms 2008: 450). The aceramic Coast Salish Indians boiled with hot rocks during the winter when stored dried food was prepared (Batdorf 1990). Wandsnider (1997: 15) explains that lean meats are boiled to restore moisture, which will assist the action of digestive enzymes. She notes that fatty meat tissues may be boiled to further lipid hydrolysis and to melt and express tissue lipids, which may then be recovered and used for other purposes (*ibid.*: 15), a point recently highlighted in relation to Irish water-boiling sites (Monk 2007). Boiling meat is also seen as an efficient cooking method to conserve fat in meat and bone, as opposed to the more wasteful practice of roasting it (Abe 2005: 119; Nakazawa *et al.* 2009: 692). Extracted fat could also have been used for nutrition to augment or supplement food *(ibid.*: 692).

These types of cooking procedures seem to have been carried out at ‘burnt rock mounds’ of Central Texas and parts of Northern Arizona (Kelley and Campbell 1942; Johnson 2009; Sullivan *et al.* 2001). These piles of fire-cracked rock range in height from 0.1–0.5m, and consisted of fired stone and cultural material overlying areas exposed to intense heat. Interpreted as the remains of fires used to process wild plant foods, these deposits have been dated to from the eight to seventeenth centuries AD (Sullivan *et al.* 2001). The evidence suggests that these were used by nomadic tribes for short-term cooking episodes. ‘Doughnut-shaped’ mounds of fire-cracked rock are also recorded from large roasting pits in the western area of the Grand Canyon. Some of this burnt stone however is associated with debris from recent nineteenth and twentieth century Hawasupai or Naajo tribes for purification rituals involving sweatlodges (*ibid.*)

In conclusion, while pyrolithic technology has been used worldwide since the Upper Palaeolithic, it became popular for the purpose of water-boiling in Bronze Age Ireland and Britain. A review of this phenomenon suggests that British burnt mounds are the only pyrolithic sites in Europe to share the morphological characteristics of Irish examples, namely a trough, hearth and adjacent burnt mound. The stone structural components identified at some burnt mound sites in the Scottish Northern Isles are unique and have no direct parallels in Ireland. That said, if some of these structures represent mound revetments and not roofed buildings, then sites souch as Ballyvourney I and Drombeg, Co. Cork (O’Kelly 1954; Fahy 1960) would be similar. The Swedish mounds of fire-cracked stone cannot be related to the British and Irish burnt mounds due to the absence of boiling troughs and dry roasting pits, as well as the distinctive range of cultural material found within them (Brindley *et al.* 1989−90: 25). While short-term, indirect cooking was also a feature of some Irish burnt stone sites, the practice was more common in central Europe. Pyrolithic water-boiling in lined, sunken troughs was most widely practised in Western Europe during this period. Therefore, the burnt stone deposits found in parts of Central and Northern Europe cannot be directly compared with Irish and British burnt mounds.

Chapter 4

The archaeology of burnt mounds in Ireland

This chapter examines the archaeological evidence from burnt mound excavations in Ireland over the last sixty years. It will primarily focus on sites excavated during infrastructural projects, although all burnt mound excavations are considered. The discussion will concentrate on the physical layout of these sites and the features identified during excavation, such as troughs, hearths, pits and other ancillary structures. Not all sites share the same morphological characteristics, with the evidence suggesting that pits were used not just for water-boiling, but for other purposes, such as roasting and for generating steam.

4.1 INTRODUCTION

The archaeology of burnt mounds has changed significantly in recent years with the result that many older excavated examples, such as Ballyvourney I and Drombeg in Co. Cork (O'Kelly 1954; Fahy 1960; CO02 and CO07), could now be regarded as atypical of the general site type. However, as most recent excavations are of essentially 'destroyed' sites, this does not discount the possibility that they may have originally shared similar morphological characteristics. Recent evidence also highlights the possibility that the technology may have been used for different purposes with the result that we may now consider different site types employing similar pyrolithic techniques. As Barber (1990: 92) observed, 'the distinctive nature of burnt mound material has seduced us into believing that all deposits of this material are produced by the same mechanism and for the same functional reason'.

In the past, research and rescue excavations of burnt mounds have focused on the most archaeologically visible features, namely the hearth and trough. Large-scale development work such as road schemes and gas pipeline projects offered a different perspective on burnt mounds, allowing larger areas to be explored often leading to the discovery of additional features. There remains the problem of proving the contemporaneity of different features and areas of activity that may not be stratigraphically related. While this has led to a number of chronological problems (see Chapter 5), the excavation of large numbers of burnt mounds in recent years as revealed new features and added significantly to our understanding of these sites. The first section of this chapter will present an overview of the excavated features and deposits found at burnt mounds in Ireland. The second section will consider site classification in light of recent excavations and will examine whether all sites can be interpreted in the same manner.

4.2 MORPHOLOGY, LAYOUT AND EVIDENCE OF SITE PREPARATION

Although there is some variability within these sites when excavated, they are generally defined by common features such as low mounds or spreads of heat-shattered stone and charcoal, and one or more troughs that are often, but not exclusively lined with wood or stone (see Hawkes 2015b). While this is the classic description assigned to burnt mounds in Ireland and Britain, the observed features can relate to a range of activities. While the basic principle of pyrolithic technology involves a method of heat transfer using hot stones, various applications of this technology can be deduced. The presence of troughs suggests a water-boiling technology as the primary activity, however the evidence also indicates that not all deposits of burnt stone were produced by the same process. Other pit features indicate that roasting, steaming, baking and steam bathing processes can also be inferred from the dataset (see below). While structural evidence is rare, the frequent presence of stake-holes suggests that temporary huts/shelters were common along with other ephemeral structures such as possible winbreaks, racks, spits or hoists.

The formal layout of Irish burnt mounds has not been discussed in any detail. Because activity at these sites generally focused around the use of a boiling pit, excavators have highlighted the possibilities that some well-preserved sites provide evidence of a formal organisation of space around a central trough (Toolis 2005; see Parker-Pearson and Richards 1994). Owing to the waterlogged conditions at many burnt mound sites, the available working space may have been limited to a small number of people. The identification of trackways and stone surfaces implies the movement of people around the central working space of a site, and the exclusive placement of the hearth and mound material on the shorter ends of the trough imposes limits on the movement of people in certain areas. Therefore, access to these spaces may have had special significance; indeed, the entire area around some troughs may have been symbolically charged. This may imply that the placement of certain features had important bearings on the use of the surrounding space, particularly where certain events (such as feasting) involved a large audience looking into the central working space. Such concerns regarding site organisation could go some way to explaining why some horseshoe-shaped burnt mounds were open at one end. It must be acknowledged, however, that the spatial arrangement of features may have been for very practical reasons. For instance, the placement of some troughs over

and adjacent to natural springs is connected to the use of fresh, clean water, which reveals a degree of planning in the sitting of many pits. While acknowledging the practical, it must also be borne in mind that the symbolic and functional are intertwined (Parker-Pearson and Richards 1994: 24). We cannot assume that everything we see is purely 'domestic' or 'functional' in character. It has been argued that people in the past did not have strict divisions between 'ritual' and 'domestic', instead most activities involved some element of both (Bradley 2005; Tilley 1996: 62).

The excavation of many burnt mound deposits reveal negative features in the form of pits, troughs and stake-holes, but there is often little or no trace of old sod levels or buried soils (Figure 4.1). However, the absence of buried soils appears to be a common feature among burnt mound sites with many deposits directly overlying clastic sub-soils. Excavations at Newtownbalregan, Co. Louth (LH23), Dromnea, Co. Cork (CO13), Mearsparkfarm, Co. Westmeath (WM53), Cahiracon, Co. Clare (Denney and Sutton 2003), Caraun More, Co. Galway (GY17) and all the sites excavated at Lisheen Mines Co. Tipperary (Cross May *et al.* 2005) showed that the burnt stone deposits lay directly over the subsoil. That said, old sod levels have survived on a small number of sites including Cooksland, Co. Meath (MH45), Carrowntreilla, Co. Mayo (Gillespie 2001; MO40), Caherweelder and Ballyglass, Co. Galway (Delaney and Tierney 2012; GY28 and GY31), Towlagh 1, Co. Meath (Carlin 2008; MH10) and Farrendreg, Co. Louth (LH19).

The absence of buried soils underlying burnt mounds may be a result of saturated ground degraded and compressed into the subsoil due to the weight of the stone mound bearing down on them. This is also connected to the process of soil podzolisation in acidic waterlogged environments. It is also possible that areas designated for long-term pyrolithic use may have been initially 'prepared', involving the removal of sod and underlying topsoil. Danaher (2001) proposed that the users may have removed the sod/topsoil to create their own working surfaces. As most burnt mounds are situated in wetland locations, ground conditions would have been wet and muddy underfoot. The removal of the topsoil would expose firmer subsoil on which working surfaces could be laid. These surfaces may have been constructed from brushwood, heather, fern leaves etc. This is supported by the presence of working surfaces/kneelers associated with troughs along with timber and stone walkways/platforms (see below) constructed to facilitate access to the site.

There are also examples where clay and other materials were deliberately introduced in order to raise ground level to providing dry areas in otherwise wet ground conditions. For instance, at Errew, Co. Leitrim (LM12a-d), three clay

Figure 4.1. Early Bronze Age burnt mound at Errarooey More, Co. Donegal. Source: Alan Hawkes.

platforms were constructed on the existing bog surface to accommodate a number of troughs of varying type (Pétervary 2007). Similarly, at Ballinaspig More 7, Co. Cork (CO43), a deposit of clay was introduced to the site during a second phase of pyrolithic activity (Hanley and Hurley 2013: 116). At Crabbsland, Co. Limerick (LK19), a large clay deposit was introduced and spread over an earlier Bronze Age burnt mound (Coyne 2001), although it has recently been suggesting that this may have been a natural occurrence relating to flooding from nearby rivers (Bermingham *et al.* 2013: 80). The clay surface was used as a platform during the Iron Age and early medieval period for possible dry roasting and metal working. Natural platforms were also used as trough locations such as examples at Boherard, Co. Laois (LS16b), Moneycross Upper Co. Wexford (WX16) and Boleybeg, Co. Kildare (KD20). There are also instances where later troughs were cut into earlier burnt mound deposits, as at Sonnagh Co. Mayo (MO47) and Islands, Co. Kilkenny (KK24a). This suggests that some sites were regularly inundated with water during different phases of use (see below).

4.3 BURNT MOUNDS

Where present in significant quantities, the accumulated waste-firing debris of charcoal-enriched sediment and heat-shattered stone is commonly referred to as a 'mound'. This reflects a period prior to recent development-led excavations, when investigations concentrated on extant monuments. While it may appear from infrastructure projects that a high percentage of burnt stone deposits never accumulated to form actual 'mounds', the excavated evidence should be viewed with caution as many sites were labelled either in antiquity or more recent times. For the most part, the deposits contain fire-cracked stone, ash, charcoal and other residue from fires, but can also contain on rare occasions cultural material such as lithics, coarse stone tools, animal bone (sometimes butchered) and prehistoric pottery. As mentioned in Chapter 1, the typical extant burnt mound is crescent, kidney or horseshoe-shape in plan, ranging 3−20m in width and < 1−2m in height. This is confirmed by the state survey programme in many parts of Ireland. Of 1148 mounds described in published county inventories, 47% of sites exhibit a horseshoe, kidney or crescent shape, while 18% are circular, 17% irregular, 14% oval and 2% D-shaped (Figure 4.3). Situated in low-lying, poorly drained land, these mounds often occur in significant clusters, with groups of up to six or more recorded, often within a few metres of each other (Power 1990; Waddell 1998; Grogan 2005).

In terms of recent excavated evidence, extant burnt mounds are rarely excavated on infrastructural schemes where the majority occur as levelled sites. Where mound/spread dimensions are recorded, 1140 examples had no surface expression prior to excavation, with an average thickness of only 0.26m (Figure 4.4). Extant mounds were recorded at 64 sites prior to investigation, with only six of these excavated under research conditions. The remainder were excavated under rescue circumstances as

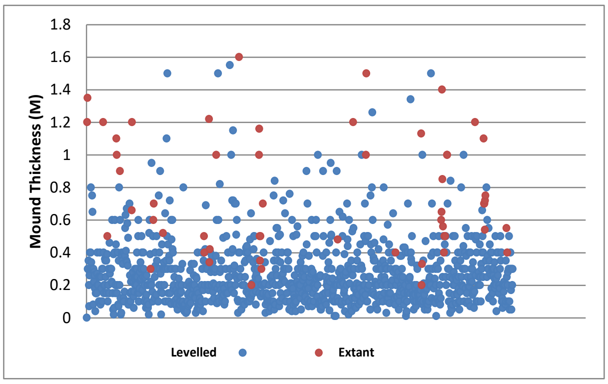

FIGURE 4.2. SCATTER CHART REPRESENTING BURNT MOUND THICKNESS AT LEVELLED AND EXTANT EXCAVATED SITES IN IRELAND.

a result of drainage works, road development or pipeline schemes. These include mounds at Derrygarrif, Co. Clare (CE58), Clonymeath, Co. Meath (MH13), Caherweelder, Co. Galway (GY28), Doughiska, Co. Galway (GY01-14), Caltragh, Co. Sligo (SO06), Ballyglass West, Co. Mayo (MO41), Attyflin, Co. Limerick (LK07), Crabbsland, Co. Limerick (LK19), Coolroe, Co. Mayo (MO12-14), Clowanstown Co. Meath (MH82), Cahiracalla Beg, Co. Clare (CE38) and Rathwilladoon Co. Offaly (CE56). Some of the larger mounds revealed in recent years lay unrecorded due to thick colluvial or peat deposits, protecting them from agricultural denudation. Examples include those revealed along the N25 Charlestown Bypass, Co. Mayo, Lisheen Mine, Co. Tipperary, and the N5 Ballaghaderreen Bypass, Co. Roscommon (Gillespie and Kerrigan 2010; Cross May *et al.* 2005).

There are recorded dimensions available for some 1355 excavated burnt mounds in Ireland. These deposits ranged in size from 0.35m (L) by 0.30m (W) to 45m (L) by 48m (W) and averaged 9.4m (L) by 7.06m (W). All contained dark silty sediment, high amounts of charcoal and heat-altered/shattered stone. 17% of these deposits displayed an irregular shape in plan with only 7% sites retaining a horseshoe/kidney or crescent shape. There is no record of mound/spread shape at 57% of excavated sites due to the sporadic nature of the deposits from agricultural and other disturbance. Some 109 spread/mound deposits were not fully exposed during the excavation due to road or pipeline wayleave constraints, while 31 were recorded as being damaged or completely removed during the testing phase of archaeological resolution.

The looseness of burnt mound material and the significant surface damage at many sites, means that the recognition of specific layers within the mound of firing debris is not always possible. This is not helped by the fact that most burnt mound excavations involve examples that have been severely altered in the past. Factors such as the arbitrary nature of the waste deposition, the weathering and leaching of exposed material, and the build-up of natural silt around the stones, mean that individual dump deposits are difficult to identify. As a consequence, mound material is often regarded as a single uniform deposit, with most archaeologists recording general composition

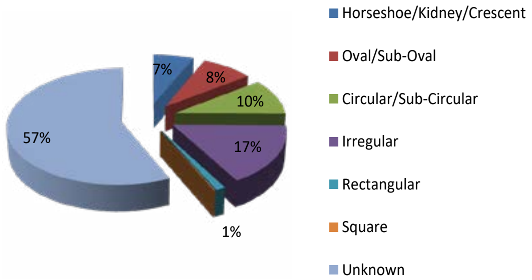

Figure 4.3: Recorded shape of excavated burnt mound/spread deposits in Ireland.

and geology, but few details of stratification. In some cases, however, a number of different use phases can be distinguished from the surviving mound material. In fact, at 63 excavated sites, a number of different deposits have been recorded. One well-preserved mound at Cahiracalla Beg, Co. Clare (CE38) was comprised of seven separate dumps of fired debris (Hull 2006). Radiocarbon dating of short-lived wood species established that the mound began to form during the Chalcolithic period and continued in use until the Late Bronze Age. There are, however, problems with the notion of continuity of site use over many centuries. The two early phases of burnt stone deposition at Cahiracalla Beg were limited in extent and may represent single burning episodes. How would people know where the site was after a few generations? Perhaps the relatively short period of between 70 and 370 years separating the Middle and Late Bronze Age phases would have been a more realistic period to be held in memory. At Caherweelder 5, Co. Galway (GY28), a series of separate deposits of heat-shattered stone and charcoal were identified, suggesting repeated and prolonged use of the site. (Figure 4.5). The radiocarbon dates support this, ranging from the Early Bronze Age to the Middle Bronze Age (Delaney and Tierney 2011: 128). At Glen, Clare Island, Co. Mayo (MO2a-b), the mound was composed of a complex series of burnt material, representing at least four distinct phases of activity (Gosling *et al.* 2007: 78). At Ahanaglogh, Co. Waterford (WD02), there is a record of 27 burnt stone deposits in the excavated portion of the mound (Tierney and Logan 2008). The Cahiracalla Beg burnt mound is significant in that it has a detailed stratigraphic sequence of deposits that provides an absolute chronology for the site.

At Bearnafunshin, Co. Clare (CE17), Caltragh, Co. Sligo (SO06), Kilmessan, Co. Meath (MH35), Bracetown 1, Co. Meath (MH43) and Brackbaun, Co. Limerick (LK60), different use phases were identified in the composition of the burnt mound, each separated by flooding events from adjacent rivers. This deposited a number of silt and clay layers between the different use phases in these sites. Excavation also demonstrated that these sites were returned to and reused after flooding. The river Tolka bordered a number of sites excavated along the M3 motorway and the fact that a number were subjected to flooding would suggest that they were not in constant use but would have been used seasonally when these locations were accessible.

The size of most burnt mounds is in proportion to the number of episodes of heating and to the tendency of different rock types to fragment under heating/quenching cycles. For instance, at Lisheen Mines, Co. Tipperary, the volume of the mound material was calculated on the basis of the various sections excavated through the mound and the knowledge of the pre-mound land surface. As micaceous sandstone can be re-used up to five times, the volume of sandstone in the original trough was divided into the mound volume and multiplied by five giving an approximate number of firings for the trough (Cross May *et al.* 2005: 243). Experiments by O'Kelly (1954) suggest that roughly 0.5 cubic metres of burnt stone is generated by a single boiling episode in a pit containing 450 litres of water. On this basis, the figure of 0.5 cubic metres of stone per boiling has been used to roughly calculate the number of boilings represented by a mound. For instance, if a mound can be calculated to be in the region of 50 cubic metres, then it may represent a minimum of 100 boilings. This may not seem many, particularly if carried out within 100 days or less. If, on the other hand, the site was used periodically (a specialised or seasonal site), then the lifespan may have stretched over a much longer period. How realistic such an estimate can be is unclear as the users would not necessarily have gathered fresh stones for each boiling, but may have reused those already in the mound. In addition, it is plausible that more stones would have been heated than actually recovered from trough deposits during excavation. There may have also been a different approach to the heating and boiling process than that used in modern experimentation. Stones may have been spared by removing when cool, and reheated until such time the temperature of the water negated such a process (Hawkes and O'Driscoll 2011–12). It is, therefore, unlikely that any comparative analysis of trough and mound size will ever give an accurate reflection of the number of uses for a particular monument.

It could be argued that mound morphology is of little importance as they were formed by randomly depositing burnt stones and fuel residue around the trough area. The archaeological evidence, however, does not support this interpretation. It is becoming increasingly clear that the structural element of the mounds was both deliberate and inextricably linked to the efficient production of hot water, the main objective of most burnt mounds. Rarely is material found deposited elsewhere around the site or used for surfacing wet or boggy areas adjacent to the trough. Where metalling is found at burnt stone sites, this is usually composed of unburnt stones or slabs placed next to the trough pit (see below). While some sites may not have mounds (see Hawkes 2015), the structured distribution of the burnt stone residues is clearly evident in more extant examples. The material is usually found adjacent to the shorter end of a trough, deposited continuously over

Figure 4.4. Shallow spread of burnt mound material excavated along the Sallins Bypass, Co. Kildare. Source: IAC Ltd and Transport Infrastructure Ireland.

Figure 4.5. Extant burnt mound during excavation at Caherweelder 5, Co. Galway. Source: Eachtra Archaeological Projects and Transport Infrastructure Ireland.

many episodes of intermittent use. Most are well defined organised mounds rather than haphazard dumps.

Retaining the mound: stone and stake revetments

Moore and Wilson observed that the presence of kerbing at some Scottish examples 'indicates that a degree of forethought was involved in the construction and management of burnt mounds and this implies that the shape and size of a mound was significant to the people who built them' (1999: 232). An organised approach is also apparent in the Irish record and is an aspect of site management not often discussed in relation to these sites. A number of burnt mounds have evidence for built kerbs or revetments, which have been interpreted as retaining features to minimise mound slippage. Such features are usually identified on more well preserved sites where the mound survives relatively intact. Revetments composed of flat stones set on edge are recorded at ten extant mounds, including the examples at Coarhamore, Co. Kerry, Cahiracalla Beg, Co. Clare and Attyflin, Co. Limerick (Sheehan 1990: 31; Bermingham *et al.* 2012: 31-33; Gahan 1998: 111). They have also been noted at unexcavated sites such as Baltimore and Glanaphuca, Co. Cork (RMP CO150-041; C0132:1/02) and Cappanagroun, Co. Kerry (RMP KY410-12) (Power *et al.* 1992: 80; Sheehan and O'Sullivan 1996). Early research excavations at Ballyvourney I and Drombeg Co. Cork (O'Kelly 1954; Fahy 1960) identified revetments consisting of U-shaped settings of stone set against the mound, retaining burnt stone deposits and preventing them from disturbing the hearth or entering the trough.

The remains of twenty other possible stone revetments have been uncovered in recent years, however interpretation is hampered by severe truncation by later agricultural activity. This was the case at sites such as Groin and Coolgarriff, Co. Kerry (KY08-09); Currinah, Co. Roscommon (RM09); Towlaght, Co. Meath (MH10); Lacarrow, Co. Mayo (MH03) and Dromnea, Co. Cork (CO13) (Dennehy 2006; Gillespie and Kerrigan 2010; Carlin *et al.* 2008; Cleary 1986). These examples consist of larger stones found at the base of mound material or at the edge or limits of the burnt spread. It is possible that these may be boulders that accumulated at the base of the mound during the use of the site. Only at Cahiracalla Beg, Co Clare (CE38) and Gortaroe, Co. Mayo (MO29), were the stones set on edge, similar to Ballyvourney I, Co. Cork (Hull 2006; Gillespie 2001). Post or stake-built mound revetments may also occur in burnt mound sites. While many curvilinear stake-hole arrangements are interpreted as windbreaks, they could also have functioned as mound retaining features. For instance, an arrangement of 30 stake-holes were found encircling a burnt mound at Knoxspark, Co. Sligo while 16 stake-holes ran along the periphery of a burnt mound at Ballinaspig More 6, Co. Cork (Deevy 2000; Hanley and Hurley 2013: 77). Both could be interpreted as enclosing and retaining fences for the mound.

The stone revetment at Drombeg, Co. Cork remains the most substantial in Ireland (Figure 4.7), with the only comparable example found at the unpublished site of Fahee South, Co. Clare (see Ó Drisceoil 1988; Ryan 1994: 124; Figure 4.6). The central space at Drombeg was enclosed by a penannular wall, which separated it from the surrounding accumulation of burnt stones (Fahy 1960). It has been suggested that these walls represent the remains of roofed buildings (Ó Néill 2009; Barfield and Hodder 1987), however there is no structural evidence to suggest this was the case. The site at Drombeg is comparable to a number of burnt mound sites in northern Britain with similar structural components. A trough and hearth at Toughs, Burra, on Shetland was surrounded by a low rectangular wall, enclosing an area measuring 4m by 3.2m (Hedges 1986). Similarly, the walls that defined a burnt mound at Meur, Sanday, were single vertical slabs no more than 1m high, with no evidence that they supported a roof. The orthostat walls at Meur probabaly served to keep the central space clear of the surrounding spread of burnt mound debris. This is similar to the low vertical slabs at Ballyvourney 1, Co. Cork that surrounded the primary and secondary hearths (O'Kelly 1954). Given the limited height and width of this stone arrangement, it is unlikely it served as the footing for a roofed building.

Figure 4.6. Stone revetment at Fahee South, Co. Clare. Source: Diarmuid Ó Drisceoil and the National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

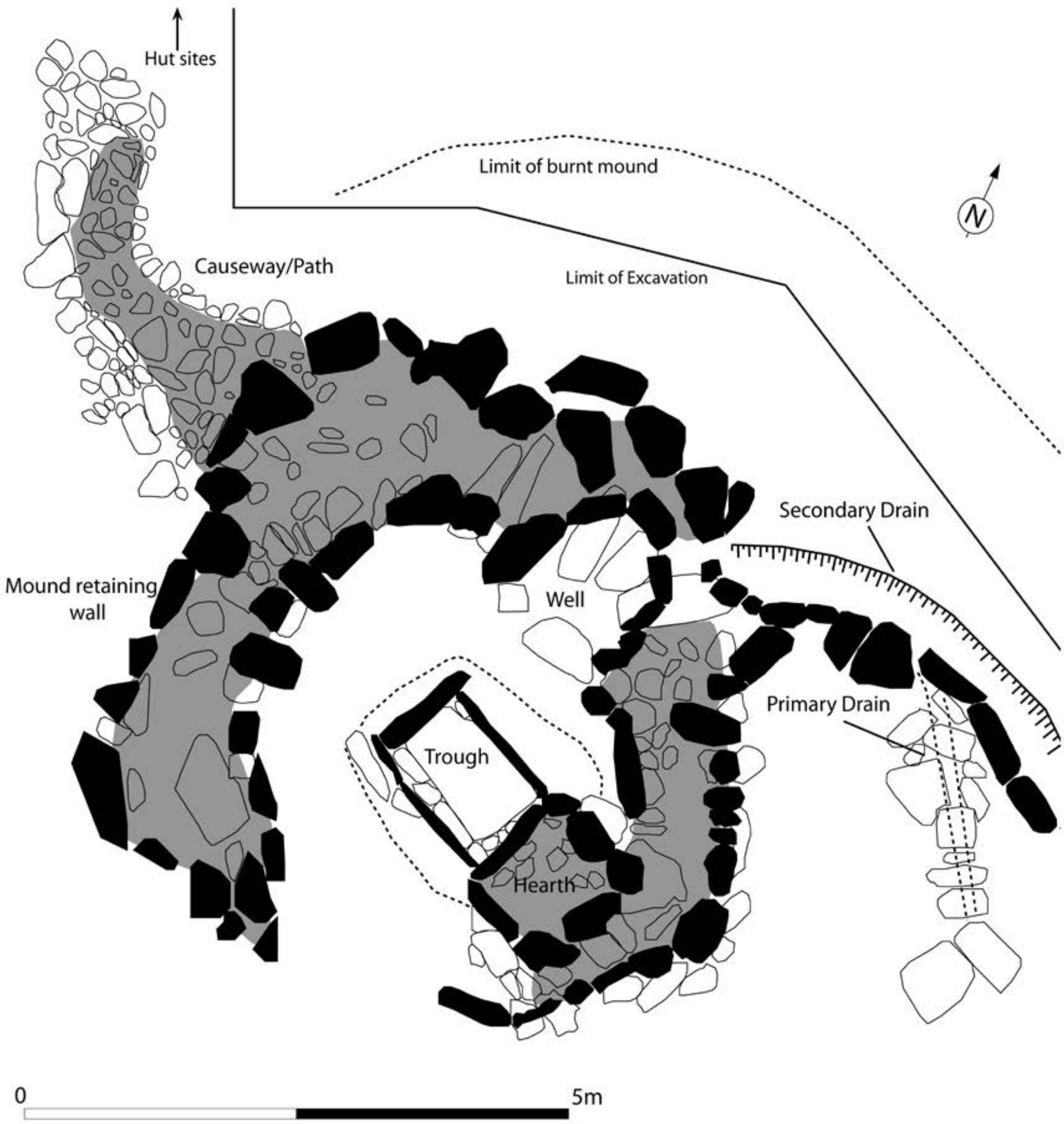

Figure 4.7. Mound retaining wall with central trough and well at Drombeg, Co. Cork. Source: adapted from Fahy 1960.

It is also possible that the accumulation of waste-firing material was undertaken for other reasons. It may be that deposits were deliberately built up and reveted in such a way as to provide shelter to a working area, helping to reduce heat loss from prevailing winds. One other effect of concentrating the debris within a limited area was to increase the height of the mound with the result that they may have been visible within the landscape. There is evidence that a layer of unburnt stone was added to a small cluster of burnt mounds at Clowanstown 1, Co. Meath (MH82), effectively consolidating access between the mounds (Mossop 2008). Similarly, a setting of six unburnt boulders on top of a burnt mound at Caltragh, Co. Sligo (SO06), seems to have been deliberately placed and covered by the final stages of burnt material (Halpin 2005). A burnt mound at Ballyburn Lower, Co. Kildare (KD18), was deposited around a large granite boulder, which the excavator suggests may have served as a 'focus point' for activity (Hackett 2009e). In other words, these boulders marked or 'monumentalised' these sites in the landscape. A similar phenomenon was noted at Woodlands East, Co. Kildare (KD37a) where a large granite boulder was identified in the northern portion of the mound. It remains unclear how accurate this interpretation is or whether this was the orginal intention of the users.

The insertion of inhumation burials in the centre of burnt mounds at Feltwell Anchor, Norfolk and Leshemstown 5, Co. Meath, must at least identify the larger mounds as visible monuments. This can also be demonstrated in South Wales, where a standing stone is sited atop a mound (Crane and Manning 1998). Instances such as these may suggest an occasional ritual or ceremonial aspect to burnt mound formation (see Chapter 7).

Figure 4.8. Overgrown burnt mound near Baltimore, Co. Cork (RMP CO150-041). Source: Alan Hawkes.

While burnt spreads and mounds would have provided a convenient dry platform for working or preparation, they also marked the location of an abandoned water-boiling site. Where the site setting was one of pasture, vegetation growth in the surrounding marshy ground would have quickly made these low-lying sites invisible (Figure 4.8). Burnt mounds are commonly the product of many 'occupations,' and so creating distinctive 'U'-shaped mounds may have been a way of identifying the location of troughs. Pyrolithic sites were commonly returned to after brief or long periods of abandonment, with troughs re-cut or re-lined for a new phase of use. Therefore, marking the location in this way may have signalled that the area was suitable for pyrolithic activity. However, this may not have been the case for all sites and it is possible some mounds/ spreads were simply a waste by-product of the pyrolithic activity. Further enquiry into the patterning of burnt mound deposits and why such material was deliberately structured and maintained is offered in Chapter 7.

Petro-morphology of burnt mounds

Sedimentary rock types seem to be the dominant lithologies used in pyrolithic water-boiling in Ireland. Sandstone (28%), followed by limestone (7%), or a combination of both (5%), are the most common (Figure 4.9). Unfortunately, geological identification is not always carried out at post-excavation stage, with 738 (51%) excavated sites having no recorded petrologies. Other rock types recorded include granite, quartz, shale/mudstone, gneiss/schist, basalt, diorite and greywacke. O'Kelly (1954: 145) argued that sandstone would have been the preferred stone for pyrolithic water-boiling based on the density of burnt mounds in sandstone-rich areas, and the unsuitability of limestone as it produces calcium hydroxide when heated and submersed in water. Later experimental testing of shatter variation in different rock types identified that drift-derived stones were most commonly used, with sedimentary rocks being the preferred material in the heating process (Buckley *et al.* 1987; Buckley 1990). Only two sites at Ballyadam and Carrigtohill, Co. Cork was the stone identified as coming from bedrock sources (Cleary and Hawkes 2013; 2014).

It has also been suggested that the use of igneous rocks in the heating process may explain the reduced number of recorded burnt mounds in the north of Ireland where these rock types are more common. Igneous rock types, such as basalt and granite, will generally only shatter after around twenty-five uses compared with sandstone at fewer than five. This may suggest that sites in the north of Ireland might be represented by a spread of stones as opposed to mounds elsewhere Buckley *et al.* 1987). However, many burnt mounds excavated in the north of Ireland are composed of sedimentary rock-types showing an apparent preference for this material for water-boiling. While igneous rock types have been identified as the dominant heating agent in some sites, sedimentary types remain the most common. The smaller number of recorded burnt

mounds in Northern Ireland may be explained by reduced field survey.

The dominance of sandstone in many burnt mounds is significant. The selection of this material highlights the attention given to different petrologies in terms of their thermal quality for water-boiling (Figure 4.10). For instance, sandstone seems to have been deliberately selected at sites such as Cloonaddadoran, Co. Laois (LS02), Carstown, Co. Louth (LH02), and Parksgrove 2, Co. Kilkenny (KK07), where the underlying natural rock was limestone (Crumlish 1998/99; Murphy 1998b; Stevens 2005). At Poldrain I, Co. Mayo (MO46) sandstone represented 70% of the burnt mound indicating that it was specifically selected and collected from surrounding fields (Murphy 2008). The excavation of a burnt mound as part of the Ballinrobe Sewage Scheme also demonstrated a preference for sandstone (Walsh 1995) (MO05−10). Whilst it is likely that this material occurred in local glacial tills, the importing of sandstone from other areas, or the preferential extraction of material from the tills cannot be ruled out. There appears to be no evidence in Ireland for long-distance transportation of stone, with most material collected from drift sources in the general vicinity of the burnt mound site.

The deliberate selection of certain stone types can also be paralleled elsewhere. In the Outer Hebrides, 'almost all of the burnt stone in the mounds comes from 5% of the bedrock which is not Lewisian Ness. This material is reduced to a course granular mass by heating and quenching' (Russell-White 1990: 87).

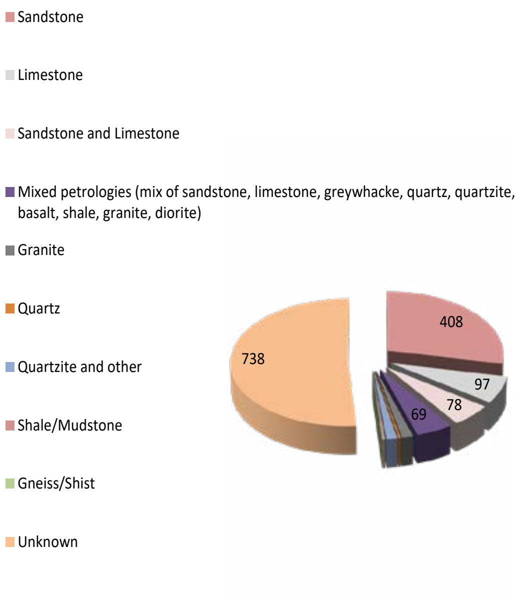

Figure 4.9. Recorded stone petrologies from excavated burnt mounds in Ireland.

Figure 4.10. Water-boiling experiment using sandstone. Source: Irish National Heritage Park, Ferrycarrig, Co. Wexford.

A huge bison processing site located in Alberta Canada contained some 4 million kilograms of fire-cracked stones of quartzite, limestone and dolerite, used in the boiling and roasting of meat. The local sandstone bedrock was avoided in favour of more suitable materials located 2km to the south (Brink and Dawe 2003: 88). Burnt mounds excavated at Parc Bryn Cegin in Wales showed a slight preference for dolerite and mafic rock types over the local Snowdonian glacial deposits (Flook and Kenny 2008: 56). Larsson (1990: 142) notes that the main distribution of burnt mounds in Sweden coincides with a belt of quartz diorite, while they are less common in areas of pure granites.

As Carboniferous limestone forms the underlying bedrock in many parts of Ireland this rock would have been easily sourced. The quarrying of such material would not have been beyond the capabilities of Bronze Age societies, particularly if we consider the proficiency of earlier Neolithic groups in sourcing stone. However, limestone does seem to have been avoided in some areas in favour of other lithologies. Limestone can become poisonous when heated above a certain temperature, reducing it to caustic calcium hydroxide during contact with water and so best avoided in cooking. Available evidence suggests that only 7% of excavated burnt mounds in Ireland are composed solely of thermally altered limestone. This adverse chemical reaction may also be the reason why sandstone was favoured in many instances. Grogan (2007: 98) has noted, however, that the quantities of calcium carbonate produced in the heating of water would not be harmful if the meat was protected and wrapped in some form of organic materials such as vegetation or straw. It is notable that limestone forms a major component of burnt mounds in the Irish midlands and was the principal stone used at many sites excavated along the Bord Gás Pipeline to the West and the N18 Oranmore to Gort Road Scheme (Grogan *et al.* 2007; Delaney and Tierney 2011: 39). Large pieces of burnt and degraded limestone were found in the base of a timber-lined trough at Curraheen 5, Co. Cork, directly implying that limestone was used to heat water (Russell 2002; Figure 4.11). The excavation of

a burnt mound at Fahee South in the Burren, Co. Clare was the first to demonstrate the feasibility of using limestone as a heating agent, as the entire mound was composed of this material (Ó Drisceoil 1988). Animal bone has also been recovered from burnt mounds composed chiefly of limestone (Ó Drisceoil 1988; Grogan *et al.* 2007; Delaney and Tierney 2011: 44), some of which displaying evidence of butchery indicating that the sites may have been used for the processing and cooking of animals.

Limestone may have been avoided in certain instances due to its limited heating potential. Mandel (2007) observed that coarse-grained rock types are better in terms of the absorption and discharge of heat, whereas fine-grained rock types, such as limestone, do not absorb heat in the same manner. Feehan (1991: 203) suggested that hard sandstones are among the most resilient for water-boiling, whereas most limestone shatters easily and some will explode hazardously when heated by fire. The temperature of the fire would also fluctuate depending on fuel used, and so the reaction of the limestone to the heat and water could vary depending on external factors. Limestone also has varying chemical and geological components depending on the source, so some lithologies react differently to others. This may be the reason why in certain experiments limestone proved to be inadequate (Lawless 1990: 8), while in others it was quite successful (Hawkes and O'Driscoll 2011−2012; Allen 1995; Ó Drisceoil *pers. comm*.). Therefore, the deliberate selection of sandstone in certain areas may have been for very practical reasons due to the limitations of the local limestone as a heating agent.

Stone and wood stockpiles

Deposits of unburnt stone have also been uncovered at excavated burnt mounds and may represent an aspect of site organisation not previously considered. While some of these deposits represent deliberately laid metalled surfaces (see below), others represent dumped material exhibiting the appearance of small cairns. These are interpreted as stockpiles of stone for use in water-boiling troughs or dry roasting ovens. Similarly, deposits of unworked wood have also tentatively been interpreted as either waste material from the construction of timber troughs or stockpiles of fuel for use in fires (Figure 4.12). As fuel and stone are fundamental resources for pyrolithic water-boiling, a considerable supply of both materials is required and it is not surprising that both would be stored adjacent to the burnt mound.

Figure 4.11. Timber-lined trough at Curraheen 5, Co. Cork, with *in-situ* burnt limestone from final boiling episode. Source: Ian Russell for ACS Ltd.

Eighteen excavated sites had deposits of unburnt stone interpreted as possible stockpiles for use in the trough . For example, at Ballydowney, Co. Kerry (KY10c), six large heat-altered stones were uncovered set in re-deposited clay in an area between the trough and the hearth. Kiely (2010) suggested these stones were used in the heating process and were not fully utilised. A partially heated stockpile of stones was also revealed at Castleinch, Co. Kilkenny (Stevens 2005; KK03). At Cahiracon, Co. Clare (CE21), and Caherweelder, Co. Galway (GY29), deposits of unburnt sandstone were discovered adjacent to the troughs (Grogan *et al.* 2007; Delaney and Tierney 2012), while at Lecarrow, Co. Mayo (MO04) a deposit of unburnt sandstone boulders and smaller stones formed part of the mound piled randomly on top of one another within a deposit of grey silt. (Gosling *et al.* 2007). A stockpile of unburnt limestone at Kilbeg, Co. Westmeath (WM41) was demarcated by two large lengths of unworked timber in an L-shaped formation (Walsh 2009). In each case the excavators suggest that the deposits represent stores of stones ready to be used in the boiling process.

Preserved pieces of wood have also been uncovered at excavated burnt mounds. In many cases, these represent some form of platform or an attempt to stabilise wet ground. Some may represent stockpiles of wood used for fuel in the hearth or offcuts from trough construction. Three possible wood piles associated with burnt mounds were found along the N25 Charlestown Bypass in the townlands of Sonnagh and Cloonaghboy, Co. Mayo (Gillespie and Kerrigan 2010; MO50, MO52 and MO64). These comprised lengths of worked and unworked roundwood deposited randomly close to the troughs. While the presence of stockpiles indicates an intention by the users to return to the site, their absence at many sites may be due to such deposits not being recognised as archaeological in nature. Instead, this material could be interpreted as natural, accumulating during flooding events or agricultural damage. Absence may also be connected to an organised abandonment, whereby all stone and wood stockpiles were depleted. As many sites are uncovered as levelled deposits, much of this material may have been completely removed by ploughing or during topsoil stripping.

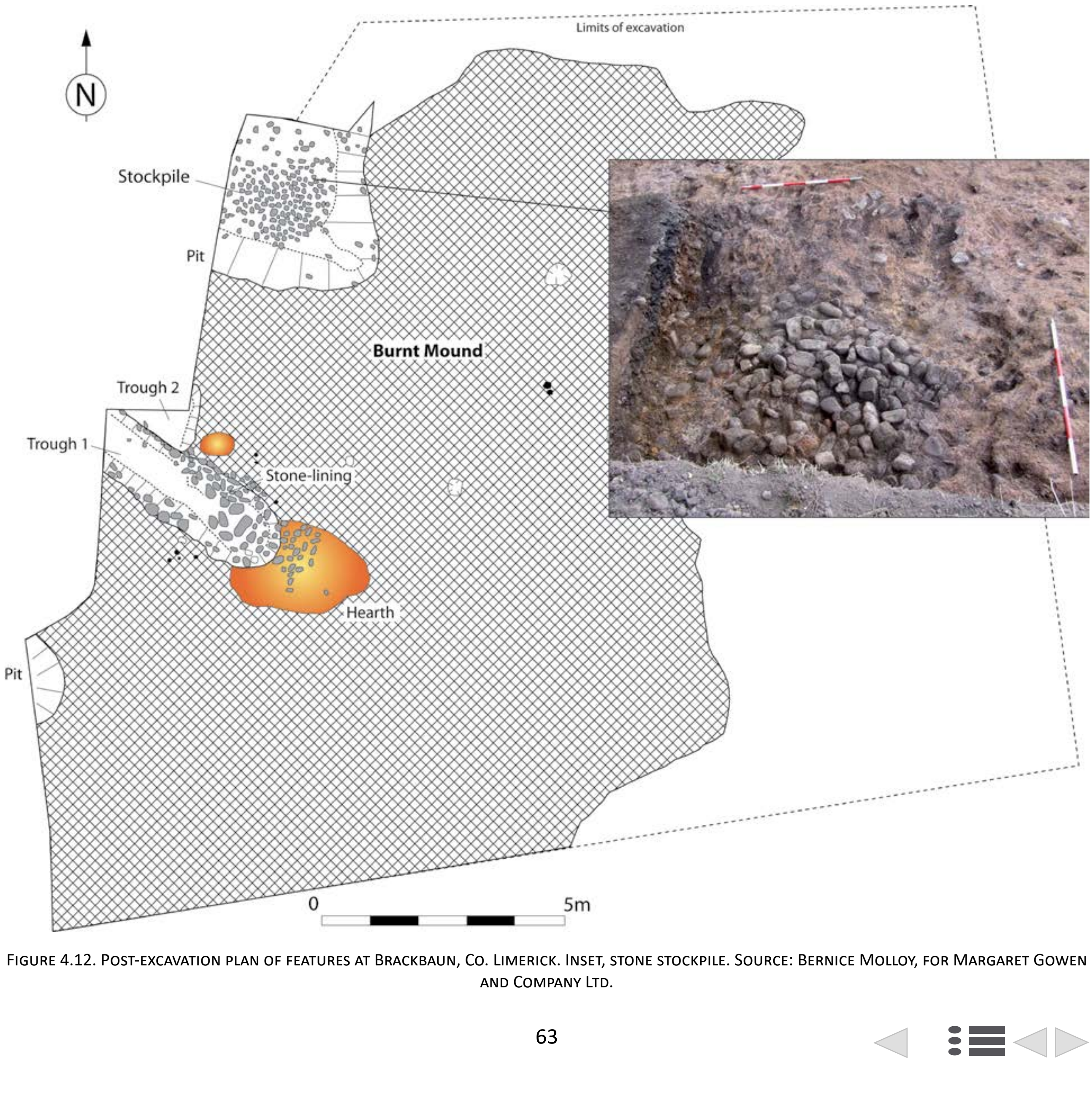

Figure 4.12. Post-excavation plan of features at Brackbaun, Co. Limerick. Inset, stone stockpile. Source: Bernice Molloy, for Margaret Gowen and Company Ltd.

4.4 HEARTHS AND FIRES

This study recorded 218 (19%) hearth features from the excavation of 1165 pyrolithic sites in Ireland. This figure is curiously low given the presence of large amounts of charcoal and burnt stone found at these sites. It suggests that many hearth or fire locations may be difficult to identify archaeologically due to their temporary and informal nature. A recent study of Bronze Age settlement in Ireland also recorded low numbers of surviving hearths, with only 50% of excavated structures provided evidence for internal fires (Cleary 2007: 218).

Hearths or fire locations can be ephemeral features that are difficult to identify during excavation. This is particularly the case at levelled or truncated sites, of the type commonly found during infrastructural development. As observed in Chapter 3, the process of recovery in advance of these schemes may unintentionally remove some underlying features, such as faint traces of oxidised soil unprotected by burnt mound material. Hearths may also be difficult to recognise at multi-phase sites where features are obscured by earlier and/or later activity.

Fire spots or hearths found at burnt mounds can be divided into three main groupings according to whether stone firing was carried out in one designated location, or whether they occurred in several places. The third variant consists of hearths on or within burnt mound deposits (Figure 4.13). Hearths can also be subdivided into different forms based on their archaeological visibility, with the vast majority (53%) surviving as small areas or depressions of heavily scorched/oxidised subsoil, or else as concentrations of ash/charcoal (16%). 15% or recorded hearths are partly stone-built or lined with paving slabs, while 7% consist of burnt deposits or possible fire locations on or within burnt mounds. Detailed information is not available for 9% of excavated examples. The size of these hearths can vary from 0.4–3.6m in length, 0.23–3.75m in width, with average dimensions of 1.4m by 1m. In at least 80 cases there was some degree of depression of the hearth area below the surrounding ground surface. Whether this depression was deliberately dug before the use of the hearth or was the result of many episodes of emptying is not clear.

Some 66 fire locations consist of 'informal' areas of oxidised subsoil or dense charcoal spreads beneath the burnt mound deposits. This term is used to describe a hearth not directly situated adjacent to the trough, but rather casually placed near or away from the trough. Some of these would be better described as possible ovens as they are set within pits deep enough for dry heat cooking or steaming (see below). Unless scientifically dated or stratigraphically connected to other pits, fire-spots such as these can be difficult to relate to specific periods of use as many sites display evidence of re-use.

'Formal' hearths, on the other hand, are usually identified in well preserved sites, where most of the burnt mound has survived intact (Fahy 1960; Cleary 1987; Cotter 2005a). In this study, the term is used to describe a hearth or fire-spot with a definite stratigraphic relationship with a trough. A total of 130 formal hearths were identified, consisting of either a semi-circular setting of stones, an area of oxidised/heat-affected soil, or a dense charcoal deposit on an elevated position immediately adjacent to the trough (Figure 4.14). In those locations, hot stones could simply be rolled into the trough. Stones may have lost heat if they had to be moved from the fire to water over a greater distance.

Gathering and transporting this material is also a consideration that must have involved the use of shovels, containers and other implements. Possible shovel blades were uncovered at Ballybar Lower, Co. Carlow (CW10), Caraun More, Co. Galway (GY17) and Ballyvollane II, Co. Limerick (LK24), while wooden implements found at Coonagh West, Co. Limerick (LK61) and Inchagreenogue, Co. Limerick (LK46) may have also been used. Implements fashioned from cow/deer scapulae may also have been used to transfer stones, however no such examples have been recovered from excavated burnt mounds in Ireland. The most likely implement to move hot stones was appropriately shaped wooden sticks taken from the fuel stockpiles.

There is a striking consistency in the location of formal hearths, in that they appear to be situated at the shorter ends of troughs and are generally not found at the longer sides. The reasoning for this may be threefold. Firstly, the position of the hearth in those areas establishes a focal point and a consistency of design that, like many other features at burnt mounds, are maintained by tradition over millennia. This indicates an additional level of spatial organisation rarely discussed in relation to these sites. The hearth will undoubtedly have held significance because of its central role as a medium of transformation, producing heat and light and facilitating the change in food from raw to cooked food, and retaining heat in stones for transportation. Secondly, and for more practical reasons, this hearth position provides additional protection from prevailing winds as the surrounding mound was often constructed in a horseshoe formation (Figure 4.16). Thirdly, it is a more efficient use of space, that provides greater access to the trough and allows for more working room in and around the central working area.

A total of 32 burnt mounds hearths are directly associated with small clusters or lines of stake-holes. While eight of these are connected to informal hearths, the majority are found with formal fire settings situated adjacent to troughs. The placement of stakes adjacent to troughs, taken in conjunction with hearths, might suggest the remains of fence structures or windbreaks enclosing those areas to protect them from prevailing winds. The presence of a fence windbreak so close to the hearth made these structure vulnerable to fire damage. That said, slot trenches at Cloone (central), Co. Waterford and at Scartbarry, Co. Cork are convincing as windbreak structures that were

possibly replaced over time (Eogan and Shee-Twohig 2011; Hanley and Hurley 2013). Some stake structures may also represent some form of spit construction or support for roasting food.

In the case of formal hearths, 35 examples were entirely or partially built of stone (Figure 4.17). Of these, 16 were bordered by a semi-circular setting of stones, sheltering the fire from encroaching mound material and prevailing winds, while 14 were lined at the base with stone slabs protecting it from wet ground and maximising air flow to heat stones with a limited fuel supply. Radiocarbon dates from 18 sites where stone hearths have been recorded all date to the Middle to Late Bronze Age (1608–500 BC), and are associated with adjacent troughs. Fourteen of the 35 stone hearths were found at sites with little agricultural damage, where the mound survived relatively intact. The construction of stone-built hearths may have been for practical reasons given the nature of the wet ground conditions at many sites. The fire is effectively raised from the ground providing a dry and stable surface for heating stones. At Ballinvinny South, Co. Cork (CO22), a thin layer of clay was added between a semi-circular stone setting that may have been revetted by a timber plank (Cotter 2005b). At Faughart Lower, Co. Louth (LH22), the hearth was composed of a basal layer of deliberately laid hazel branches. There is ample evidence that fenland and lake-margin sites contained complex hearths that were built on layers of branches or logs, sometimes topped with a coating of clay or flag stones to keep the hearth dry from moisture (Audouze and Büchsenschütz 1989: 110; O'Sullivan 1997: 83).

At Garranes, Co. Cork (CO57), the stone-built hearth allowed for the efficient use of fuel and its westerly orientation and funnel-shaped opening allowed for directed air-flow for adequate draughting (O'Brien 2012a: 117; Figure 4.15). The stone lining in the central chamber could also be regularly replaced by inserting new slabs, removing the need to re-build the structure (*ibid.*). Many stones used in such hearths display evidence of heat damage indicating the need for replacement over time. For instance, the double setting of stones at Kilnagleary, Co. Cork (CO01) may indicate a re-lining of the hearth due to prolonged use (Ó'Riordáin 1937).

Formal hearths or burnt surfaces should be visible if the fire exceeds some 300–375° C, since mineral soils will discolour at this temperature (Canti and Linford 2000: 393). However simple fires built on a normal humic topsoil surface rarely heat the underlying soil enough to cause significant reddening (*ibid.*: 392). This may explain the absence of any hearth locations at some sites. Alternatively, hearths may have been placed above ground on a layer of clay, wood or stones, or they may have been positioned on the accumulating burnt mounds. This would have provided a dry platform in otherwise waterlogged conditions where hot stones could be easily rolled into the trough. Such fires are unlikely to leave any archaeological trace, though heavier concentrations of charcoal in some burnt mounds may represent such locations (Gosling *et al.* 2007: 264). Twelve such deposits identified in excavated urnt mounds can beinterpreted as areas of burning or hearth locations. These include Bofeenaun, Co. Mayo (MO01), where areas within the burnt mound were rich in charcoal and sand (McDermott 1995). Similar concentrations were noted at Attireesh and Deepark East, Co. Mayo (MO23 and MO17), while deposits of scorched clay were identified in mounds at Roevehagh, Co. Galway (GY30) and Dalystown Co. Westmeath (WM03).

It seems reasonable to conclude that charcoal-enriched sediment and burnt stone found at excavated sites does not entirely account for raked out hearth deposits over considerable periods of time. It is likely fires were often placed on existing burnt stone deposits as they accumulated, creating the mixture of charcoal in the mound characteristic of what is found during excavation. It is likely that many hearths were raised. This would provide more draft to enable a hotter fire and also affectively maximise the efficiency of the burning episode, by heating stones placed both on top of the fire and beneath it; also the raised mound greatly facilitated the transferral of hot rocks into the trough, as well as providing a dry work area on which to light the fire.

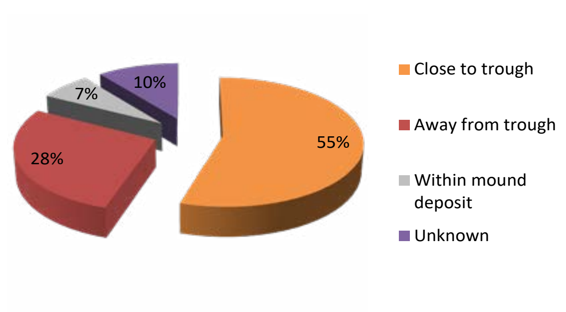

Figure 4.13. Location of hearths at excavated burnt mounds in Ireland.

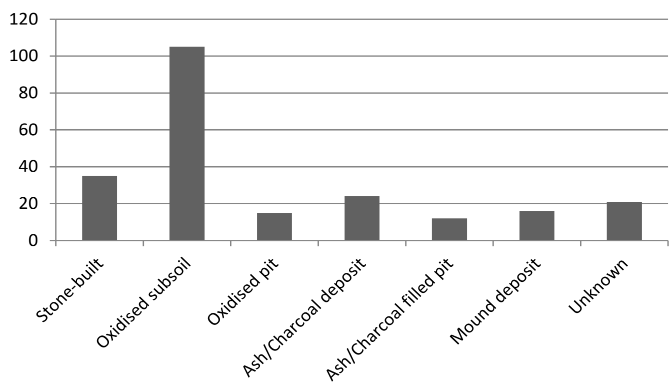

Figure 4.14. Hearth types recorded from excavated burnt mounds in Ireland.

Figure 4.15. Formal stone-built hearth and trough at Garranes in the Beara Pennisula, Co. Cork. Source: William O'Brien UCC.

Figure 4.16. Stone-built hearth and associated trough at Killalough, Co. Cork. Source: Eamonn Cotter for Sheila Lane and Associates.

Cat No.	Site	County	Formal	Stone-Built	Date Range
CO22	Ballinvinny	Cork	Y	Y	1640–1490 BC
CO05	Killeens phase 1	Cork	Y	Y	1610–1450 BC
NC	Valentia Island	Kerry	Y	Y	1766–1281 BC
KK14	Ballynamona	Kilkenny	Y	Y	1498–1417 BC
CO57	Garranes	Cork	Y	Y	1493–1311 BC
CO21	Killalough	Cork	Y	Y	1433–1333 BC
CO81	Carrignafoy	Cork	Y	Y	1433–1271 BC
KK23	Newrath	Kilkenny	Y	Y	1413–1289 BC
CO13	Dromnea	Cork	Y	Y	1440–1260 BC
KY10	Ballydowney	Kerry	Y	Y	1490–1200 BC
CO09	Kilcor South	Cork	Y	Y	1300–1170 BC
CO54	Scartbarry	Cork	Y	Y	1440–1020 BC
MO69	Cloonmeen West	Mayo	Y	Y	1390–1054 BC
NC	Cloone Northern	Waterford	Y	Y	1263–1056 BC
CO94	Coolmoohan	Cork	Y	Y	1119–937 BC
CO16	Meenane	Cork	Y	Y	1004–810 BC
CO50	Fermoy	Cork	Y	Y	830–780 BC
CO07	Drombeg	Cork	Y	Y	770–400 BC

Figure 4.17. Selection of excavated stone-built hearths from burnt mounds in Ireland. Radiocarbon dates calibrated at 2-sigma. NC= not catalogued.

4.5 TROUGHS

Ó Néill (2005:82) listed four aspects to pyrolithic technology, namely production, apparatus, by-products and produce. Production refers to the processes involved in creating the by-product, i.e. the heated stone to boil water, whereas the apparatus required would be a trough. These are generally sunken pits adjacent to hearths that are often lined with stone or timber. The absence of some form of visible lining in excavated examples cannot be taken as ensuring that they were unlined during use. It is also difficult to decide whether some pits or depressions should be considered troughs. In this study, the opinions of excavators have been followed where these are supported by the physical evidence; namely evidence for lining, a roughly geometrical shape, steep sides and a flat base. These are the typical characteristics of a water-boiling trough. Where a pit does not have any evidence for lining, and the measurable volume is considerably less than 1m³, the feature is generally interpreted as having some other function.

Of the 545 pits identified by Ó Néill (2009), 117 were definitively interpreted as troughs. Some 226 are classified as pits, while a further 202 could only be defined by shape with no other additional information available. In all, nineteen different pit types were identified by Ó Néill, mostly classified by shape or lining type (*ibid*.: 81). It is apparent, however, that an over-emphasis placed on trough shape may have inadvertently complicated site classification as much of the evidence used by Ó Néill was based on preliminary excavation reports. As a result, no diagnostic patterns emerged except the possibility of a sequence where rectangular forms are later than circular troughs (Ó Néill 2000a: 19).

The current study indicates that 1481 (45%) pit features out of a total of 3271 from burnt mounds excavated between 1950 and 2010 have been interpreted as boiling troughs. Details relating to trough form suggest that almost half (48%) are rectangular in plan, while oval forms account for 24% and circular forms 20%.The remainder are either irregular (3%) or square (1%), while 4% of troughs were not fully defined during excavation. It is important to note that the shape of the trough may have had little bearing on function, and many examples have been altered through intensive use or later disturbance. For example, a number of unlined troughs excavated in Co. Laois along the M7/M8 road scheme display gently sloping sides, interpreted as the result of being repeatedly emptied by hand (Wiggins 2008). The insertion of a timber component may have also influenced the shape of a trough, as many timber-lined troughs are placed within larger irregular pits.

The recorded troughs vary widely in size and capacity. Rectangular/sub-rectangular examples range in size from 0.63-6.62m in length (average 2.23m), 0.38-4.43m in width (average 1.4m), and 0.03-1.3m in depth (average 0.40m). The average volume of rectangular troughs is 1.520m³, equivilant to 1520 litres of water when full. In terms of shape, there has been a degree of subjectivity in distinguishing sub-rectangular, oval and sub-circular

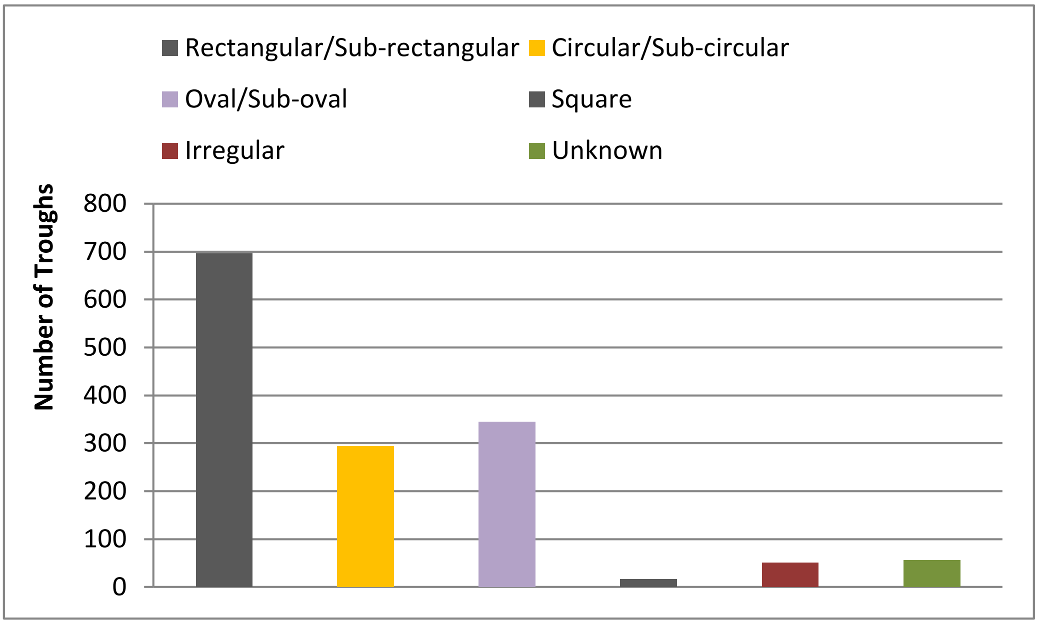

FIGURE 4.18. FREQUENCY OF RECORDED TROUGH SHAPES FROM EXCAVATED BURNT MOUNDS IN IRELAND.

forms (Figure 4.18). As observed by Eogan and Shee-Twohig (2011: 267), 'oval troughs are generally of similar dimensions and proportions to rectangular and sub-rectangular troughs but have rounded sides and ends'. Oval/sub-oval troughs vary from 0.8-5.2m in length (average 2m), 0.25-4.34m in width (average 1.4m), and 0.07-1.6m in depth (average 0.44m). The average volume of oval troughs is calculated at 1.354m³ (1354 litres). Circular/sub-circular troughs range in size from 0.60-4.15m in length (average 1.77m), 0.31-4.41m in width (average 1.5m), and 0.05-1.32m (average 0.45m). The calculated average volume of circular troughs is 1.390m³ (1390 litres).

The recorded depths range from 0.03m–1.6m and are on average 0.42m deep; however, most examples are 0.21m–0.5m (Figure 4.19). The insertion of a wooden or stone lining could have altered the internal dimensions of the trough pit. Most troughs are found overlain with spreads and mounds of burnt stone that protected them from truncation. Many display evidence of truncation from deep ploughing or from the excavation of drainage ditches. A total of 335 pits identified as troughs have lengths of between 2.5m and 862m, suggesting some specialised use involving bathing activities or food preparation on a large scale, possibly for feasting (see Chapter 7).

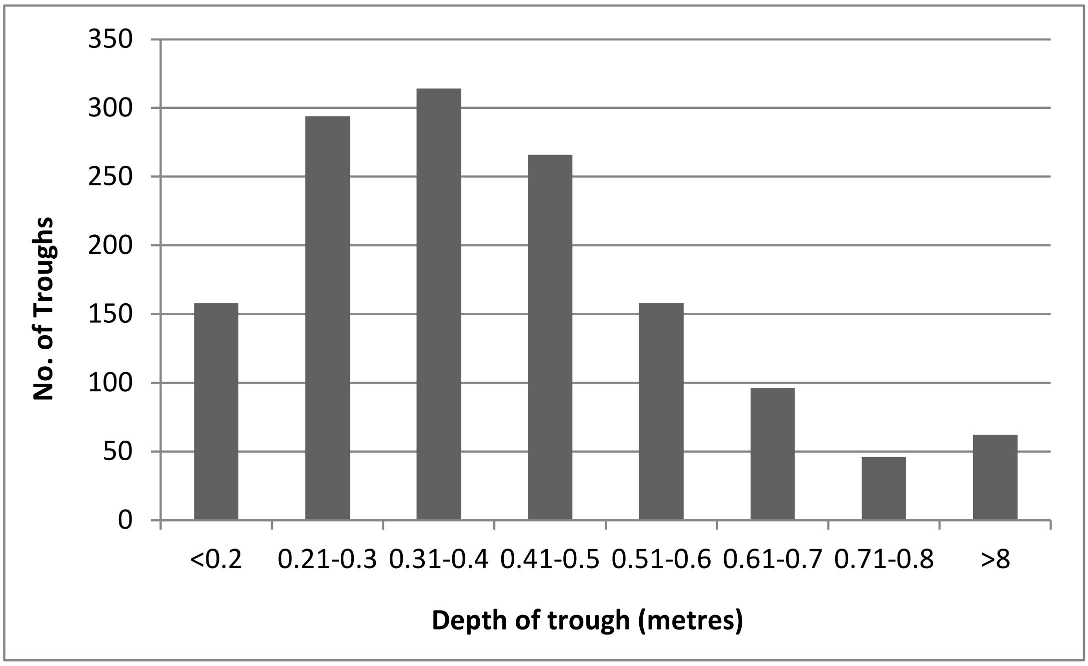

FIGURE 4.19. RECORDED DEPTHS (M) OF BURNT MOUND TROUGHS IN IRELAND.

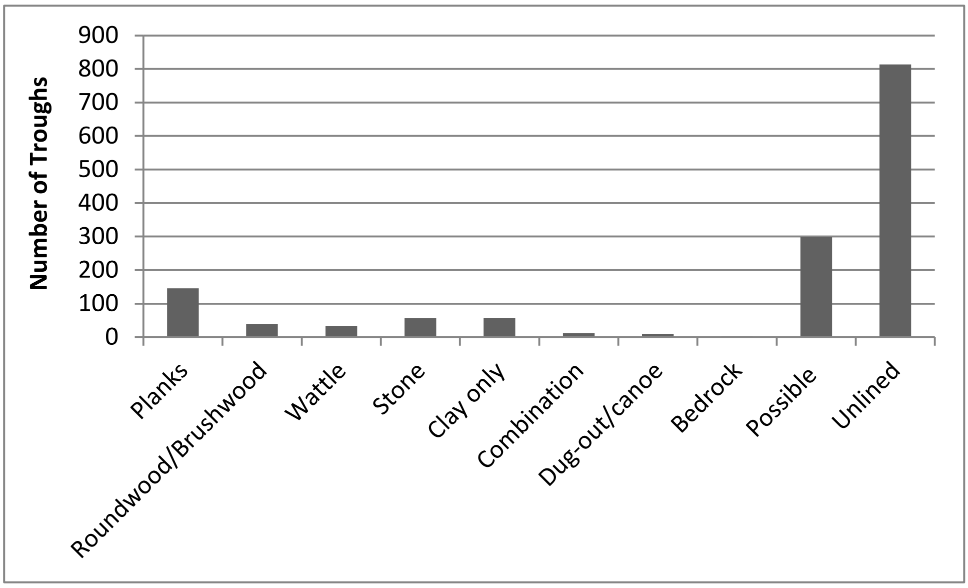

Figure 4.20. Recorded trough linings from excavated burnt mounds in Ireland.

Excavation records indicate that 327 sites have evidence for two or more troughs, suggesting replacement of these features over the prolonged use of a site. The presence of substantial mounds of heat-shattered stone at some sites with single troughs indicates that these examples were reused a considerable number of times, if this is not obvious in the stratification of the mound. As mentioned previously, the nature of mound deposits generated by the use of pyrolithic technology means that detailed stratigraphic analysis is sometimes not possible. Where evidence exists for multiple phases of use on a site, it is seen principally in the form of the re-cutting and re-lining of troughs (this is discussed further in relation to site histories in Chapter 5).

Trough linings

A total of 378 troughs (26%) display evidence of a surviving timber or stone lining. A further 298 examples (20%) exhibit stake-holes, cutting the base and sides, suggesting the presence of a former organic trough lining. Twelve troughs have evidence for internal divisions or compartments, possibly used to separate materials from the fired stone during the boiling process. Seven different lining methods have been observed in Ireland (Figure 4.20), while natural bedrock was utilised in four examples, namely at Ballyglass West, Co. Galway (Delaney and Tierney 2012; GY31), Monanny, Co. Monaghan (MN03), Carrowkilla Co. Clare (Grogan *et al.* 2007; CE28) and Barnahely, Co. Cork (McCarthy 2002). This leaves 814 trough pits (55%) recorded as unlined, though the use of organic lining may have been more common than the archaeological record suggests. Problems of poor preservation make it difficult to quantify the frequency of wood-lined troughs. Their interpretation as troughs is generally based on their relative depths and whether the pit had straight sides and a flat base. Troughs may have intentionally been left unlined in dryer areas not prone to waterlogging negating the use of a stone or timber lining to minimise trough collapse. The excavation of troughs in areas where natural clays were solid and impervious may have been another reason why linings were not used. In these scenarios the troughs required manual filling from an adjacent water source.

The archaeological evidence suggests that troughs were lined with either timber planks, roundwood or wattlework, or else with stones. In rare occasions, troughs appear to be constructed of both timber and stone. Where pits display evidence of internal stakes, it may be taken as evidence that the trough was originally lined with wood. This has been confirmed in cases where preserved timber troughs have been found with internal stakes used as supports for side walls. Some troughs were clay-lined, while this was not necessary for examples dug into natural impermeable clays. While water was heated in unlined pits, the addition of a timber or stone lining allowed for a more efficient way of water-boiling in that it maintained the pit structure in wet ground conditions and facilitated regular emptying of heat-shattered stone from the trough. The recorded use of moss and other organic material as a bedding layer under the base and between side timbers is unlikely to have been used to make the pits watertight as suggested by others (Ó Drisceoil 1980). Instead, this probably allowed the filtering of dirtier water, tainted by surrounding boggy environments. Spagnum moss may also have had effects on the water chemistry, filtering minerals, softening water and lowering the acidity. This must remain speculation in the absence of any supporting evidence. Concentrations of sand noted on the base of many troughs are unlikely to have been intentionally deposited as bedding or filtering layers (Gillespie and Kerrigan 2010: 145). This sediment may have accumulated from natural silting or as a residue from the shattering of hot stone.

Unlined troughs

As previously mentioned, a high percentage of troughs (55%) do not display evidence of internal linings. Their interpretation as troughs is generally based on their size and proximity to the burnt mound, and whether the pit displays straight sides and a flat base. The absence of a lining in many cases reflects aerobic soil conditions, where wood does not survive. Alternatively, troughs may have been left unlined in areas not prone to waterlogging and where natural subsoil was hard, where a stone or timber lining was not necessary to minimise trough collapse. The digging of troughs in impermeable clay may have been another reason why linings were avoided. Some 298 of these unlined troughs are rectangular/sub-rectangular, 198 are circular/sub-circular, 228 oval/sub-oval, while 28 are irregular and 7 are square (no information available for 40 sites). Some of these unlined troughs were also shallow with most 0.2m–0.5m in depth, averaging 0.43m. Of these, 26 filled naturally with water, with seven from underlying springs. A number of unlined pits interpreted as possible troughs were also too deep or shallow to have functioned as water-boiling receptacles. Allowing for the possibility of truncation, shallow pits less than 0.2m in depth probably had other uses, while pits with depths greater than 1m probably did serve as water-holding features or wells. One trough at Groin, Co. Kerry (KY08) was recut at a later period and used for iron smelting, while another at Ballinaspig More 7, Co. Cork (CO43) was re-used as a possible roasting oven (Dennehy 2006; Hanley and Hurley 2013). Three other troughs at Cahiracon, Co. Clare (CE23), Killaspy, Co Kilkenny (KK13) and Parksgrove, Co. Kilkenny (KK06) exhibited such evidence where they were later re-used for a different purpose.

Clay-lined troughs

Clay is sometimes found between planks or joints of stone-lined pits and is often interpreted as a sealing agent (see below). In other cases it is recorded as the sole lining material, particularly in areas where ground conditions were not conducive to water seepage. Thus, it is implied that the clay helped to retain the water in the trough that was probably manually filled from a nearby water source. In some cases, however, this may not have been an intentional lining and may instead relate to water-lain deposits or troughs dug into natural clays. Examples include Cloghers and Dromthacker, Co. Kerry (Kiely 2003; KY06a-b; Cleary 2008; KY04a-b) and Carrigtohill, Co. Cork (Cleary and Hawkes 2014). There are a small number of examples where a deliberate lining of clay served as a base layer that was applied to the floor and walls of the pit prior to the insertion of a timber or stone structure. This was the case at Lisnagar Demesne, Co. Cork (Hanley and Hurley 2013; CO52), Ballyglass West, Co. Galway (Delaney and Tierney 2011; GY31), Smuttanagh, Co. Mayo (MO45a) and Kingstown, Co. Dublin (Clinton 2002; DN03). A total of 58 possible clay-lined troughs have been excavated in Ireland, with a further 10 linings combined with timber or stone structures to make the pit watertight. Ó Néill's study (2009) records only a single example of the latter at Rathbane South, Co. Limerick (LK13), one of his 'Type 18' classification of circular clay-lined troughs. The shape of these troughs vary, with rectangular and circular (36% for each), with the remainder oval or irregular in plan. A trough at Kingstown, Co. Dublin (DN03) is the only deliberately clay-lined example associated with a water-channel or gully, of the type usually interpreted as an overflow drainage feature (Clinton 2002: 10). However, as that example is clay-lined it would have required manual filling from the adjacent palaeochannel and as such, an overflow drain would not been necessary. Alternatively, the channel may have functioned as water inlet gully allowing water to fill the trough more easily when the water-table was higher (see below).

Stone-lined troughs

Stone-lined troughs are particularly uncommon when compared with examples found in the Scottish Isles (Anthony 2003; Thelin 2007). This was first noted by Ó Drisceoil in the early 1980s and the picture has changed little since. For instance, Ó Néill's (2009: 108) study only records eleven troughs of this type in Ireland, all rectangular in shape. This may be related to the post-abandonment history of sites where deep ploughing disturbed or completely removed in-situ stone slabs from the trough sides. It is also possible that stones may have been removed for re-used elsewhere. The availability of stone in certain areas may have also contributed to the minimal use of stone as a trough lining. At more extant examples, where damage has been limited, the *Archaeological Survey of Ireland* has identified stone troughs at unexcavated sites protruding from the ground between the arms or 'horns' of the burnt mound such as at Lispatrick Lower, Co. Cork (RMP CO137-3) and Baltimore, Co. Cork (RMP CO150-041) (Power *et al.* 2000). This has also been the case at Drombeg, Co. Cork (Fahy 1960; CO07) and Coarhamore, Co. Kerry (Sheehan 1990; KY03) where the sites were not exposed to the same level of disturbance as other areas.

A total of 57 stone-lined troughs (4%) have been recorded since 1950 in Ireland, with average dimensions of 2.4m by 1.54m and an average depth of 0.49m (Appendix 1: Figure 10.1). The majority (70%) are rectangular in plan, with the remainder oval (16%), circular (10%) or square (4%). Four examples have associated paving slabs adjacent to the pit serving as kneelers (see Cleary 1987; Sheehan 1990; Gillespie and Kerrigan 2010; O'Brien 2012a). Often, only the base of the stone-lined trough survives due to later truncation. Construction methods vary but most are built of large flat slabs that line the sides and base, with some evidence of deliberate shaping in order to fit the stones tightly together (Figure 4.21; Figure 4.22). This was the case at Garranes, Co. Cork and Cahircalla Beg, Co. Clare (O'Brien 2012a; Birmingham *et al.* 2012). Five troughs were lined at the sides with rougher sandstone or limestone blocks, as recent Castlecooke and Butlerstown Little, Co. Cork (CO95 and CO18) and Brackbaun, Co. Limerick (LK61). A further six examples had evidence of

Figure 4.21. Oval stone-lined trough at Casheldufe IV, Co. Mayo. Source: Agnes Kerrigan for Mayo County Council and Transport Infrastructure Ireland.

Figure 4.22. Stone-lined trough at Garranes townland in the Beara Peninsula, Co. Cork. Source: William O'Brien UCC.

Figure 4.23. Roundwood-lined trough at Sonnagh I, Co. Mayo. Source: Richard F. Gillespie for Mayo County Council and Transport Infrastructure Ireland.

Figure 4.24. Roundwood-lined trough at Bockagh, near Ballaghaderreen, Co. Roscommon. Source: IAC Ltd and Transport Infrastructure Ireland.

internal stake-holes to provide additional support for the heavy side walls.

Clay was also used to seal the exposed joints of some stone troughs. This was noted at Ballyglass West, Co. Galway (GY32) and Lisnagar Demesne, Co. Cork (CO52) suggesting the troughs would have required manual filling. A stone-lined trough at Errew, Co. Leitrim (LM12a) was cut into a artificial clay platform, which would have also helped to retain water in the pit. This trough would have also required manual filling. After a number of boiling episodes, sediment and fired debris would become trapped between the stones and other joints, effectively sealing the trough and making it watertight. Stone-lined troughs at Drombeg, Co. Cork (CO7), Leahy's, Co. Limerick (LK52), Currinah, Co. Roscommon (RM09), Garranes, Co. Cork and Dromnea, Co. Cork (CO13) filled naturally with water during excavation, suggesting that the hydrology has changed little since the sites were in use. Stone-lined pits at Ballymaley (CE02) and Cahiracon (CE23), Co. Clare , Putiaghan Upper, Co. Cavan (CN15) and Blanvillespark, Co. Kilkenny were initially interpreted as troughs. Several of the lining stones displayed evidence of scorching, suggesting that these 'troughs' may have functioned as ovens for dry heat similar to examples at Ballyvourney I, Co. Cork (CO02) and Leacarow, Co. Mayo (MO03) (see below).

The use of stone-lining tradition was particularly prevalent in Ireland during the Middle to Late Bronze Age periods, with 34 examples securely dated to 1500–500 BC. The construction technique is particularly common in rectangular forms probably due to difficulties in fitting slabs smoothly around curves of circular and oval examples. The latter have been recorded at Cashelduff, Co. Mayo (MO62) and Garranes, Co. Cork (CO57).

Roundwood-lined troughs

This form of lining has been identified in 37 troughs (3%) and is particularly common in rectangular forms (Figure 4.23). Of these, 28 rectangular/sub-rectangular troughs and nine circular or oval forms were lined with roundwood. The lining comprises a series of roundwood branches or brushwood tightly packed together along the sides and base of a trough and held in place by stakes in each of the corners (Figure 4.24; Figure 4.25). Often, a number of different techniques are used in the same trough, ranging from rods to split roundwoods to planks. For instance, finely-worked planks are sometimes found at the shorter ends of roundwood-lined troughs, such as those found at Ballyglass, Co. Sligo (SO22) and Ballyvourney, Co. Cork (CO02). The most common wood species used in the construction of these troughs is a mixture of alder, ash and hazel, with occasional willow and oak. It is likely that roundwood was collected locally with minimal working of this material for use as trough lining. Where preservation conditions are good, compressed moss is commonly found under the base and side timbers acting as a filter for clean water. A total of 21 of the 37 examples were

Figure 4.25. Roundwood-lined trough with corner supports at Bofeenaun, Lough Moore, Co. Mayo. Source: Conor McDermott.

found to contain moss lining at the base, indicating that the structures filled naturally with water. The identification of moss under and between these timbers also suggests roundwood troughs may only have been constructed in areas where they filled naturally with water, as the moss acted as a filter. The use of roundwood also gives an indication of the tools used. For instance, the presence of inverted and raised tooling mark signatures on some of the wood indicates that a number of axe heads had been used. In addition, the identification of a number of jam curves of varying sizes would also seem to suggest the use of small and mid-sized metal axes or palstaves with slightly curved blades. The use of a stone axe was identified from a number of willow branches used to line a trough at Gortaroe, Co. Mayo (MO30) dated to the Chalcolithic period (Gillespie 2001). It is likely that roundwood was collected locally with minimal working of this material for its use as trough lining. The use of roundwood or split roundwood in the construction of trough linings does not indicate the type of delicate woodworking noted in some plank-lined troughs (see below). The identification of moss under and between these timbers also suggests roundwood troughs may only have been constructed in areas where they could fill naturally with water, as moss would have acted as a filter. The lining technique would also appear to be common during the Middle to Late Bronze Age (Appendix 1: Figure 10.2).

Wattle-lined troughs

Wattle-lined troughs are increasingly common in the Irish record, particularly as a result of discoveries on recent infrastructural developments (Figure 4.26). They are quite distinctive, with a basic set of characteristics. They are mostly circular (although some rectangular examples are known) and were built using a series of upright stakes placed around the internal perimeter of the trough. These stakes are interwoven with horizontal sails (Figure 4.27). The linings are exclusively made of hazel or willow and are only found along the side walls of troughs while the bases are lined with planks or flat stones (Figure 4.28). There are exceptions, such as Killoteran 11, Co. Waterford (WD16), where the base was unlined and Killoran 253, Co. Tipperary (TY04), where the base was lined with transversely placed hazel rods (Eogan and Shee-Twohig 2011; Cross-May *et al.* 2005).This wattle-lined form of

trough construction allows for a more straightforward way of lining a sub-rectangular, oval or circular trough and limits the amount of woodworking required. A review of the excavated evidence confirmed that pits with a high proportion of internal stake-holes around the perimeter are generally interpreted as evidence of a wattle-lining that no longer survives. Thirty-four surviving wattle-lined structures were discovered in Ireland over the past 20 years with a further 31 possible examples (Appendix 1: Figure 10.3). Of the surviving wattle elements, six have evidence of internal partitions or compartments possibly used as a means to separate cooked food from the fired debris. This is recorded at Dromnevane, Co. Kerry (KY21a), Dunlo, Galway (GY32a), Gortaroe, Co. Mayo (MO27) and Balreask, Co. Meath (see Chapter 6 for further discussion). The identification of wattle linings in the archaeological record challenges previous suggestions that organic linings were used to make a pit watertight. The use of wattle to line a trough pit did not make a trough impermeable, rather the lining allowed water to seep into the trough. This interpretation is supported by the presence of sphagnum moss used as a filter in a number of examples.The evidence suggests that these trough forms are amongst the earliest types constructed for pyrolithic technology in Ireland and are were particularly common during the Chalcolithic (2500–2000 BC). Where wattle-linings survive intact, five troughs are radiocarbon dated to this period, with some thirteen dated by charcoal from associated fills. Several troughs that display evidence of former wattle-linings are also dated to this period. Later examples have been identified at Caraun More Co. Galway (GY16) and Prumplestown Lower, Co. Kildare (905–800 BC) (KD38), dated to 1058-901 BC and 905-800 BC respectively. Similarly, charcoal from the fill of a wattle-lined trough at Coolroe, Co. Mayo (MO13) is dated to the Middle Bronze Age (1387–1215 BC).

Plank-lined troughs

The use of wooden planks is the most common method of trough lining in prehistoric Ireland, with 145 (10%) examples (Appendix 1: Figure 10.4). The use of carefully dressed planks demonstrates the competent woodworking involved in this form of trough construction. Plank-built troughs generally survive in the archaeological record as either partially-lined pits (usually base planks) or as whole timber structures where anaerobic conditions allow for preservation. These linings are most commonly found in rectangular troughs, with some 105 examples that average of 2.1m in length by 1.3m in width by 0.4m in depth. Of these, 48 examples have accompanying stakes/stake-holes or pegs used to support the sides and possibly to help fasten the base planks together (Figure 4.29). While planks often line the base of wattle-lined troughs, circular or oval pits were rarely lined with planks due to the difficulty in fitting these around the curving sides.

A number of exceptions are known from the archaeological record. This study has identified twelve circular/sub-circular and seventeen oval types where plank-lining was used. It must be noted that some ovoid forms may have originally been rectangular structures set into differently shaped pits.

Cat No	Site	County	Shape	Lining	L (M)	W (M)	D (M)	Stakes	Date range
MO27	Gortaroe	Mayo	Sub-rect	Y	0.67	0.66	0.09	Yes	2857–2495 BC
MO20	Deerpark East	Mayo	Circ	Y	0.9	0.9	0.1	Yes	2465–2205 BC
WD16	Killoteran	Waterford	Oval	Y	1.78	1.52	0.55	Yes	2460–2140 BC
RM03	Hughestown	Roscommon	Oval	Y	2.1	1.3	-	Yes (24)	2456–2035 BC
MH13	Cloncowan	Meath	Oval	Y	-	-	-	Yes (23)	2290–1920 BC
LM12c	Errew	Leitrim	Circ	Y	1.2	1.2	0.24	Yes	2200–1960 BC
RM12	Kilbegly	Roscommon	Oval	Y	1.62	1.12	0.4	Yes	2134–1944 BC
MO51	Sonnagh	Mayo	Oval	Y	1.8	1.1	0.4	Yes (3)	2134–1919 BC
WW22	Charlesland	Wicklow	Rect	Y	2.26	2.05	0.95	Yes	2137–1909 BC
WM15	Heathstown	Westmeath	Oval	Y	1	1.45	0.15	Yes (12)	2120–1890 BC
MH33b	Balreask	Meath	Oval	Y	1.72	1.72	0.32	Yes (23)	2060–1920 BC
MO03	Lecarrow	Mayo	Oval	Y	1.6	1.1	0.07	Yes (18)	2041–1892 BC
WM41a	Correagh	Westmeath	Rect	Y	1.5	1.1	0.29	Yes	2032–1899 BC
WW50	Coolacork	Wicklow	Oval	Y	1.6	1.4	0.8	Yes	2130–1780 BC
RM16	Banada	Roscommon	Circ	Y	1.8	1.8	-	Yes (7)	2009–1771 BC
SO05	Ballinacar	Sligo	Sub-rec	Y	1.15	0.88	0.22	Yes	1907–1692 BC
MH04	Lisdornan	Meath	Oval	Y	1.85	1.3	0.3	Yes	1960–1540 BC
GY17	Caraun More	Galway	Sub-rec	Y	2.6	1.6	1.3	Yes	1667–1393 BC

Figure 4.26. Surviving wattle-lined troughs excavated in ireland with associated dating evidence. Radiocarbon dates calibrated at 2-sigma.

Figure 4.27. Preserved wattle-lined trough excavated by Siobhan McNamara (ACSU Ltd) at Deerpark East 1, Co. Mayo. Source: Richard F. Gillespie and Transport Infrastructure Ireland.

Figure 4.28. Preserved wattle-lined trough excavated at Coolacork, Co. Wicklow. Source: Yvonne Whitty for IAC Ltd and Transport Infrastructure Ireland.

Figure 4.29. Late Bronze Age plank-lined trough excavated at Cahiracon, Co. Clare. Source: Emer Dennehy.

Alternatively, truncation of the pit walls in more recent history may have altered the shape of the pits while wattle walls in some may have been removed leaving only the base planks *in situ*. This may leave an over-representation in the number of circular and oval-shaped pits lined only with planks. That said, a small number can be interpreted as circular plank-lined troughs. They include Cloneen, Co. Clare (CE66), where a sub-circular trough was lined at the base with overlapping planks while the sides were lined with nine vertical overlapping ash planks (Figure 4.30). Bayley (2010) suggests that this overlapping may helped to keep the trough watertight. Two ash stakes were then driven into the base of the trough at opposing sides in order to stabilise the lining. A similar trough design was identified at Warrenstown, Co. Kilkenny (KK28a).

Excavation confirms that base planks were usually inserted first, followed by the side walls and supporting stakes. In the majority of cases the base planks are laid parallel with the side timbers as opposed to being laid transversely in the pit. In rare cases, such as at Rathmore, Co. Kerry (KY02) Cahiracon, Co. Clare (CE22), Clashroe, Co. Cork (CO14) and Killeens, Co. Cork (CO3), grooves were set into the base planks to facilitate the placement and tight fit of the side planks. Others have more complex timber constructions, such as the mortised plank box troughs at Killoran, Co. Tipperary (TY03) and Ratheen, Co. Limerick (LK01). An 'X' mark recorded on a base plank at Fauleens, Co. Mayo (MO59), may have been used to identify the middle plank in the construction process. Alternatively it may denote some other form of a woodworker's mark,

Figure 4.30. Rare, oval plank-lined trough excavated at Caheraphuca, near Crusheen, Co. Clare. Source: IAC Ltd and Transport Infrastructure Ireland.

similar to others at Sonnagh, Co. Mayo and Derrindiff, Co. Longford (O'Carroll 2010; Moloney *et al.* 1993: 39).

Planks were used either half, radially or tangentially split and often reveal evidence of woodworking. These splitting techniques could have been achieved using heavy mallets, wooden or bone wedges and hammerstones, examples of which have been found at excavated burnt mounds. A possible wooden mallet from a burnt stone deposit at Inchagreenoge, Co. Limerick (LK46) could have been used for splitting timbers in the construction of the timber-lined troughs. Wood-chips associated with woodworking have also been found at Johnstown 1, Co. Meath (MH74) and Killoran, Co. Tipperary (TY04). They are absent at other well preserved sites, suggesting that this woodworking may have taken place elsewhere, though probably in the general vicinity. Toolmarks are often sharp and well defined with flat or concave surfaces, generally thought to be diagnostic of bronze axes. For example, the jam curves identified on several timbers from Early Bronze Age troughs along the N5 Ballaghaderreen Bypass in Co. Roscommon indicate the use of narrow bladed axeheads. Comparable jam curves on wood sampled from Fauleens 1, Co. Mayo, are dated to the Early Bronze Age. O'Carroll (2010) suggests that the presence of varied axe signatures on some samples and their absence from others indicates that different woodworking tools were involved. A comparison of tool imprints from particular axe types shows that the facets are wider and shorter in the Early Bronze Age and longer and narrower in the Late Bronze Age (*ibid*.). The skill involved in wood splitting is demonstrated by the different conversion methods used to make trough planks. Plank-linings are usually composed of oak (29%), alder (14%) or ash (7%), and can sometimes be constructed using a number of different species. Tangentially split oak and alder planks were commonly used as base timbers. Ash timbers are generally half splits (O'Carroll 2010: 142). The trough timbers could not be identified to species at 63 (43%) sites due to the degraded remains of the wood or absence of specialist study. Plank-linings are common throughout the prehistoric period with examples dating from the Late Neolithic to the Early Iron Age. However, the avaible dating evidence indicates that the majority date to the Middle-Late Bronze Age.

Dug-out canoes and hollowed-out tree trunks

A number of troughs made from a single piece of wood may represent re-used logboats formed by hollowing-out a large tree trunk. Sixteen examples have been found, twelve from controlled excavation, four of which are from recent development projects (Figure 4.34). All examples are of oak wood, with the exception of one from Derrybrusk 1 and 2, Co. Fermanagh, made of alder. They usually survive

as single pieces of wood set into an elongated pit, often supported by stones along the sides. Where found, they are generally situated immediately adjacent to a formal hearth, such as at Killalough and Clashroe, Meelin, Co. Cork (CO21 and CO14), Clonkerdon, Co. Waterford (WD01) and Killeens, Co. Cork (CO03) (Figure 4.31: Figure 4.33). These trough types fall into Ó Néill's (2009: 100) 'Type 6' pit classification of linings manufactured from a single piece of wood. He identified thirteen examples in his study, however only ten of these can be confirmed as hollowed-out trough forms.

One of the earliest recorded examples of this type was found in 1885 at Clonkerdon, Co. Waterford (Quinlan 1885; Figure 2.2). A similar example was discovered in 1897 associated with burnt stone deposits at East Muskerry, Co. Cork (Gregory 1997, 562). The antiquarian, William Hackett stated that 'the average dimensions of the troughs already found may be given as six feet long, two feet broad, and one foot three quarters deep, except the hollowed trees, which are sometimes longer and narrower' (1854: 59). This is supported by Redmond's (1885: 404) description of a burnt mound discovered in Ardmore, Co. Waterford. He states that the farmer whose land it was, broke the 'vate', and used half of it as a trough for his pigs'. Although it is not specified, this was most probably a hollowed out tree trunk used as a trough. Many of these discoveries were mistakenly identified as boats, from the nineteenth century (see Chapter 2). This study suggests that only two examples can be confirmed as canoes re-used for pyrolithic water-boiling. A hollowed-out trough at Killalough, Co. Cork (Cotter 2005a) was formed by splitting an oak trunk longitudinally, then hollowing out one half (Figure 4.31), the preferred method in log-boat construction (Dunne and Doolin 2001: 22). A groove noted at one end of the trough could have been used to attach ropes to vessel to allow more efficient manoeuvrability during transportation. At Curraghtarsna, Co. Tipperary, the trunk was split down its length in two places to form the base and two sides. End beams consisting of unworked tree trunks were then pegged into position at the long ends (Buckley 1985: 70). This has also been identified as a re-used canoe or log-boat (Brindley and Lanting 1996).

Figure 4.31. Logboat/Canoe reused as a water-boiling trough at Killalough, Co. Cork. Source: Eamonn Cotter for Sheila Lane and Associates.

Figure 4.32. Dug-out trough at Treangarrow, Co Mayo. Not catalogued. Source: Joanna Nolan for Mayo County Council.

While the examples at Killoran, Co. Tipperary (TY05), Tomies, Co. Kerry (NC), Cuilmore and Tonregee Co. Mayo (NC; Shimwell and Cribbin 1996) and Teronea Co. Clare (NC) were initially identified as possible canoes, they were discounted by Dr Niall Gregory as boats due to unusually thick sides and bases, and the large amount of wood left at both ends and handles. All of these features would, according to Gregory, have mitigated against their use as boats by creating low freeboard, directional instability, poor manoeuvrability and large displacement (in Dunne and Doolin 2001: 22). Due to the state of

Figure 4.33. Dug-out trough excavated at Clashroe, near Meelin Co. Cork. Source: Maurice F. Hurley.

preservation, it cannot be established whether some other examples originally functioned as canoes. Ten of these troughs have been securely dated to 1900–800 BC. Three are dated using dendrochronology to *c.*1500 BC, namely Killalough, Co. Cork (CO21), Ballynagard, Co. Clare (CE16) and Tomies East, Co. Kerry (NC). Somewhat misleading is the radiocarbon-dated stake at Kiloteran 7, Co. Waterford (WD15), found adjacent to a hollowed-out tree trunk. This may instead relate to the nearby vertical watermill at Kiloteran 9, dated to the early seventh century (Eogan and Shee-Twohig 2011: 13). The Middle Bronze Age evidence from the burnt mound material is more likely to date the pyrolithic activity at the site.

Possible lined troughs

Pits interpreted as 'possibly' lined include those with evidence of internal stake-holes/plank slots, burnt or decayed linings, or examples where worked planks or stakes were recovered from trough fills. For the latter, it cannot be conclusively established whether such worked timbers originated from a lined trough or another context. The current study identified 310 troughs as being possibly lined, where timbers have either decayed in situ or been removed before the site was abandoned. Some 248 of these displayed evidence of internal stake-holes, either along the sides or more often in the corners, acting as supports for side timbers (Figure 4.35). The numbers of stake-holes in these troughs varies from one to 42. In rectangular and sub-rectangular troughs, stake-holes are most common, with 154 examples displaying one or more stake-holes (2–4 stake-holes are most frequent (83 troughs), generally found in each of the corners. In 21 troughs of this form, more than 10 stake-holes have been identified clustered in each of the corners or along the sides, with the latter indicative of a possible wattle-lining. In circular and sub-circular forms, 31 examples display evidence of one or more stake-holes generally found surrounding the base. For example, 22 stake-holes cut the base of a sub-circular trough at Greenhills. Co. Tipperary, while 33 stake-holes were found in the base of a circular trough at Rathbane South, Co. Limerick. Similarly, in oval/sub-oval forms, 52 troughs displayed evidence of stake-holes akin to circular examples where the majority clustered along the base suggestive of the presence of wattle sides similar to examples discussed above.

Combination of materials (stone and timber)

This form of trough construction is rare in the archaeological record and was first identified at Ballyvourney I, Co. Cork (CO02). Here, the boiling pit was lined on the shorter ends by stone slabs and on the long sides by horizontally stacked birch and oak roundwoods (O'Kelly 1954). Since then, 15 additional troughs have been found with a combination of timber and stone linings (Figure 4.36). A number of troughs have also been re-lined using different methods

Cat. No	Site	County	Species	L (m)	W (m)	D (m)	Date range	Dated sample
NC	Cuilmore	Mayo	Oak	2.8	0.5-0.8	0.3	1915–1519 BC	Trough fragment
CO14	Clashroe Meelin	Cork	Oak	1.8	0.6	-	1910–1730 BC	Trough fragment
NC	Teronea	Clare	Oak	-	-		1683–1509 BC	Trough fragment
CO05	Killeens	Cork	Oak	5	1	0.3	1610–1450 BC	Trough fragment
CO21	Killalough	Cork	Oak	3	0.7	0.2	1535±9 BC	Trough fragment
NC	Tonregee	Mayo	Oak	3.5	0.6	0.25	1494–1132 BC	Trough fragment
NC	Curraghtarsna	Tipperary	Oak	2.6	1.2	-	1492–1306 BC	Trough fragment (peg)
CE16	Ballynagard	Clare	Oak	2.07	1	0.42	1476±9 BC	Trough fragment
NC	Tomies East	Kerry	Oak	4.8	0.95	0.4	1471±9 BC	Trough fragment
TY04	Killoran	Tipperary	Oak	2.7	0.6	0.15	1425–1120 BC	Adjacent platform
FH03	Derrybrusk 2	Fermanagh	Alder	3.7	1	-	1260–1001 BC	Trough fragment
FH03	Derrybrusk 1	Fermanagh	Alder	0.73	0.62	-	1193–931 BC	Trough fragment
CE49	Caheraphuca	Clare	Oak	2.75	0.66	0.35	1016–900 BC	Charcoal (trough fill)
WD15	Killoteran	Waterford	Oak	2.6	0.65	0.1	AD 430–600	Hazel stake
WD01	Clonkerdon	Waterford	Oak	1.8	0.6	-	None	Not sampled
NC	Treangarrow	Mayo	Oak	2.6	0.62	0.32	1492–1298 BC	Not known

Figure 4.34. List of excavated dug-out troughs with dating evidence in Ireland. Radiocarbon dates calibrated at 2-sigma. NC=not catalogued

such as at Derryfadda, Co. Tipperary (TY01), Cahiracon, Co. Clare (CE23) and Lisdornan, Co. Meath (MH04).

The use of stone in these troughs is usually confined to the shorter ends (seven sites) or for use at the base (five sites) with either split planks or roundwoods used at the long sides. Supporting corner stakes are also commonly found and have been identified at eight sites. At Fauleens, Co. Mayo, the stones were used as supports for the timber trough, and were placed on the western end (Gillespie and Kerrigan 2010: 104). Such methods of construction suggest that these troughs filled naturally with water. This is supported by excavation, where 14 examples filled naturally during investigations. The presence of filtering material such as moss also suggests that the troughs filled naturally through percolating ground water. Furthermore, the use of such materials makes for considerable gaps between planks, allowing water to escape. Therefore, it seems reasonable to conclude that troughs that display both stone and timber would have filled naturally with water. Where clay is used in combination with timber-linings it is often used to level the base for the insertion of planks, such as at Moneycross Upper Co. Wexford (WX16) and Cooksland Co. Meath (MH45). This may also suggest the trough was filled manually from an adjacent water-source, as seems to have occurred at Lusk, Co. Dublin (DN22), Annaholty, Co. Tipperary (TY45), Ballinter, Co. Meath (MH31a-c) and Rathmore, Co. Wicklow (WW07).

Observations on trough form

While many troughs retained the basic rectangular form, the archaeological record indicates considerable variation in trough design. Trough shape does not appear to show a chronological sequence and radiocarbon dating has shown that specific trough shapes are not restricted to particular periods but are spread across the entire date range for burnt mounds. It is likely that various functional and social factors determined their form, with larger troughs possibly used for a greater output of food during periods of feasting or bathing activities. There does, however, appear to be a development in relation to internal trough linings (Figure 4.37). Wattle-lined troughs are on present evidence a Chalcolithic/Early Bronze Age tradition, whereas stone-lined pits and hollowed-out forms are more common during the Middle to Late Bronze Age. Plank-linings, on the other hand, were prevalent throughout the Bronze Age, with the earliest examples found in Late Neolithic contexts.

Rectangular, plank-lined troughs in their complete form represent a certain level of woodworking skill and a design that was used over a long period of time. These troughs would have taken a considerable period of time to construct, while others made from roundwood and wattling would have taken shorter periods, assuming as is likely, that the wood was sourced locally and the techniques were well established. This highlights the effectiveness of certain designs and raises the question of function, given that the circular troughs were also in use at the same time.

Figure 4.35. Trough pit with stake-holes in each of the four corners at Mullenmadoge I, Co. Mayo. Such evidence indicates that the pit was probably plank-lined with supporting corner posts. Source: Richard F. Gillespie for Mayo County Council and Transport Infrastructure Ireland.

Figure 4.36. Stone and roundwood-lined trough at Currinah IV, Co. Roscommon. Source: Agnes Kerrigan for Mayo County Council and Transport Infrastructure Ireland.

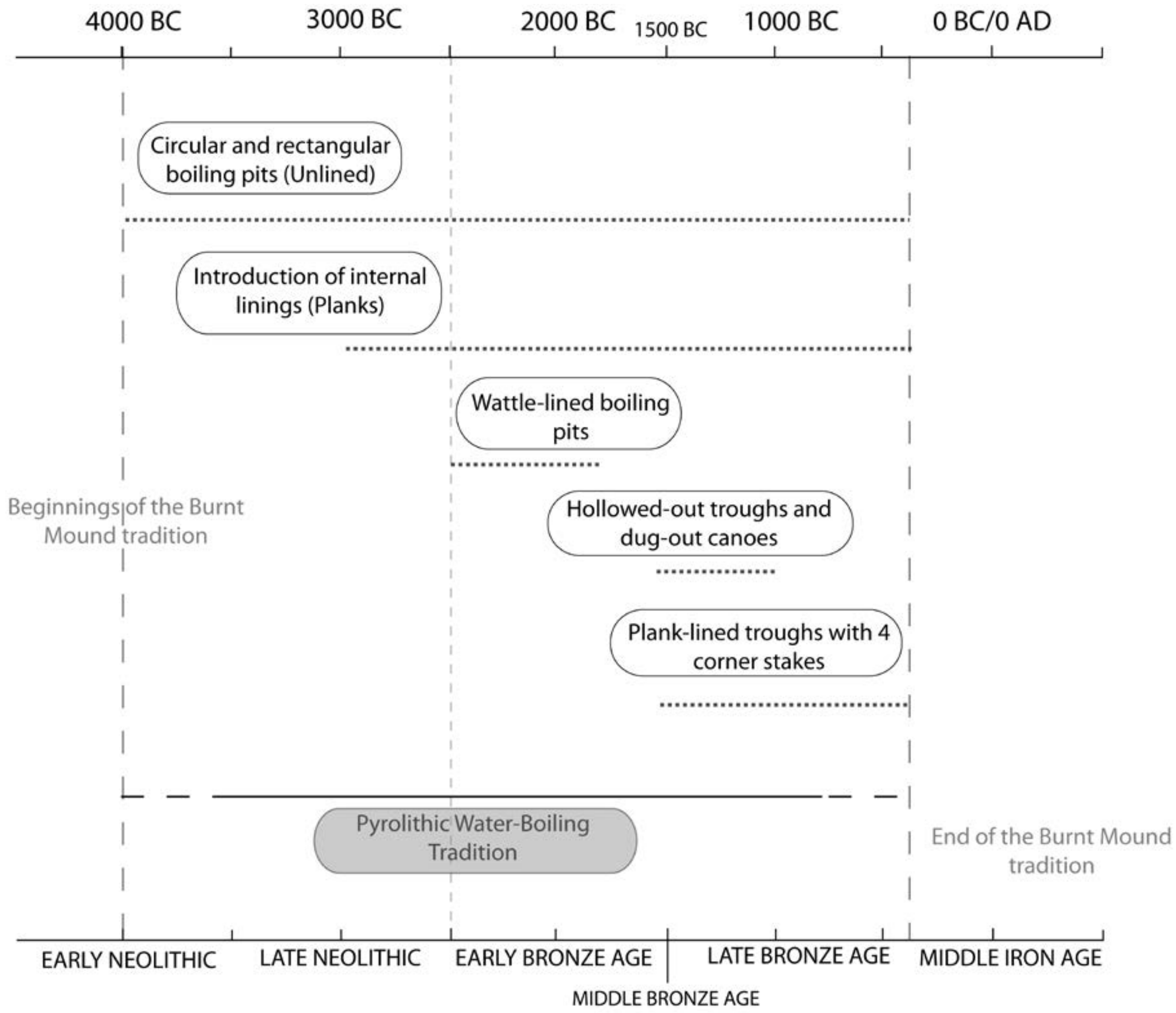

Figure 4.37. Proposed trough development in Ireland.

It had previously been observed that troughs began to be lined sometime after 2000 BC (Ó Néill 2000a), but recent excavations confirm this practice occurred at an earlier date in Ireland.

4.6 WATER-CHANNELS

Water management features are not a new phenomenon at excavated burnt mounds (Hodges 1955; Fahy 1960), but have become increasingly common in recent site investigations and highlight a design component not previously recognised. The displacement of water and the movement of people in the immediate vicinity of a trough would have made the edges of an unlined trough quite unstable, therefore a mechanism to transport excess water would have been useful. In Ireland, these channels are usually interpreted as simple overflow channels, allowing excess water to be directed away from the trough and working area of the site (see Walsh 2009a; O'Brien 2012a; Cleary and Hawkes 2013). They have also been identified at some burnt mounds in Britain associated with wells and trough pits (Pitts 2009; Donnelly and MacGregor 1996: 64). While the majority are interpreted as simple overflows, some features appear more complex. In many excavations, little attention is paid to the surface contours of immediate trough areas and whether water was being directed into the trough from upslope or fed out of the pit downslope. These channels can be interpreted in a number of different ways; either as overflow outlets, water inlet channels or emptying/drainage features associated with adjacent pits (Figure 4.38).

Water-channels have also been recorded associated with springs, deep pits and wells (see below). Although a degree of caution should be applied to the interpretation and dating of these features, their relationship with water-retaining features implies a direct association in most cases. It has also been proposed that they functioned as primitive steaming pits, where heat was generated into a confined environment to bend timbers for construction purposes (Danaher 2007; Ó Néill 2009). This is based on an example uncovered at Caltragh 6, Co. Sligo (SO15), where the pit could have been used to vent steam through the channel which was possibly covered with either sods

or hides (Danaher 2007: 25). A similar feature identified as a 'tadpole' pit was excavated at Berrilstown 2, Co. Meath (MH67). The excavator observed that a steam bending interpretation is unlikely as the process involves the timber to be passed through or held within a 'former' where a line of stakes should be present along the edges of the linear gully (Rathbone 2008: 11). No such stake-holes were recorded at Berrilstown 2, Co. Meath.

Overflow and drainage channels

A growing number of troughs have channels at their lower ends, where the natural ground level falls off gently. As heated stone is added to a trough, a mechanism to direct overflowing water may have been required, especially where troughs fill naturally. Some 49 troughs have been identified with channels interpreted as overflow outlets. They include examples at Garranes, Co. Cork (O'Brien 2012; CO57), Ballinaspig More 7, Co. Cork (Hanley and Hurley 2013; CO43), Kilbeg, Co. Westmeath (Walsh 2009; WM35), Ardskeagh Beg, Co. Galway (GY34) and Ballyadam, Co. Cork (Cleary and Hawkes 2013; CO75). Surviving channels are often short in length and do not exceed a few metres. At Correagh 1, Co. Westmeath (WM42a), a trough was found associated with a wooden launder, which extended downslope towards a former stream bed (Lynch 2009). Another wooden structure tentatively identified as a launder is recorded at Caheraphuca 8, Co. Clare (Bayley 2009; CE51). These are the only timber examples identified in Ireland to date associated with burnt mounds.

Overflow channels are not the only features affiliated with trough water management. A number of troughs have been identified with accompanying pits at lower levels, connected by short channels. Eleven examples identified in Ireland may have functioned as emptying receptacles, allowing standing or used water to be released from the pit, to be replenished later. For instance, at Balloo, Co. Down, a rectangular, plank-lined trough was connected to a lower pit separated only by a possible sluice system (Dunlop 2007; DW10c). At Ballinglanna North, Co. Cork (CO71), the remains of a possible stone-lined trough was connected to a lower spring or well by a short water channel (Tierney 2010). A rectangular trough at Clonymeath, Co. Meath (MH14) connected to a lower pit was interpreted as the remains of a possible reservoir, as it did not fill naturally with water and there was no immediate water-source nearby (Grogan *et al.* 2007: 322). Similar arrangements were observed at Ask, Co. Wexford (WX06; Figure 4.40), Carrigtohill, Co. Cork (CO79), Monreagh 1, Co. Clare (CE67) and Dunkitt 8, Co. Kilkenny (KK15) (Bower 2010; Cleary and Hawkes 2014; McNamara 2009; Eogan and Shee Twohig 2011: 107). An alternative explanation is that these lower pits may have been used to hold 'used' water released from the trough above for another, separate activity. This was implied at examples such as Correagh 1 Co. Westmeath (WM41a), Burrow and Glenanummer 3 Co. Offaly (OY08) and Ballybar Lower Co. Carlow (CW10) (Lynch 2009; Coughlan 2009; Hackett 2009a). While it is possible the water in the larger pits were used for a separate function, such as bathing, it is more likely their purpose was to store water, given the absence of any other obvious adjacent water sources. Their use for other activities, such as bathing, cannot be ruled out.

Some channels were cut by a number of stake-holes forming a line where they terminate. It is suggested that these stakes functioned as supports for a wooden sluice allowing water to be released into the lower pit. Examples have been identified at Ballybar Lower Co. Carlow (CW10), Balloo Lower Co. Down (DW10c), Mearsparkfarm 5, Co. Westmeath (WM55) and Killeagh Co. Cork (CO99) (Hackett 2009a; Dunlop 2007; Cagney 2009; Gilligan 2010). This would have controlled water supply to the trough while in use. Alternatively, the stakes may have formed a small wattle screen to filter water as it entered the reservoir after being released from the trough above. At Carrigtohill, Co. Cork, it is suggested that the large pit functioned as a reservoir or cistern to contain a semi-permanent water supply that was derived from surface water provided by an additional channel (Cleary and Hawkes 2014). It may be that water was heated to the necessary temperature in the trough before being released into the lower pit via the sluice system (Figure 4.39). This may have allowed burnt stone to be removed before the process could begin again. In this scenario, the connected features functioned to separate the heat-shattered stone and fired debris from the water, with the additional wattle structure acting as a filter. It is suggested, based on the identification of reservoirs, that these trough examples had to be filled manually.

Some channels can be connected to a series of features that imply not only the emptying of water, but the movement of water between pits. This is reminiscent of a production line where each pit may have served a separate function. It must be noted, however, that the contemporaneity of these features remains problematic especially where gullies or water channels are absent from the site and pits are abutting each other. Some of these features may represent multiple phases of events, where troughs were re-cut in the same location, as at Lissava, Co. Tipperary (TY29), Gortaroe, Co. Mayo (Gillespie 2001; MO29) and Killeens Co. Cork (O'Kelly 1954; CO03). In some cases, however, a direct relationship seems reasonable, where troughs were used concurrently suggesting the movement of water between pits. This was evident at Cahiracon Co. Clare (CE22), Burrow or Glennanumer Co. Offaly (OY08), Ardskeagh Beg Co. Galway (GY32) and Kilbeg, Co. Westmeath (WM35).

Water-inlet channels

While the above channels are associated with the displacement of water from a trough, there are others that were connected with the supply of water to the trough either from a natural spring, a nearby river/stream or utilising the fall of a slope to collect rainwater. Six troughs in Ireland have displayed such evidence and can be interpreted as

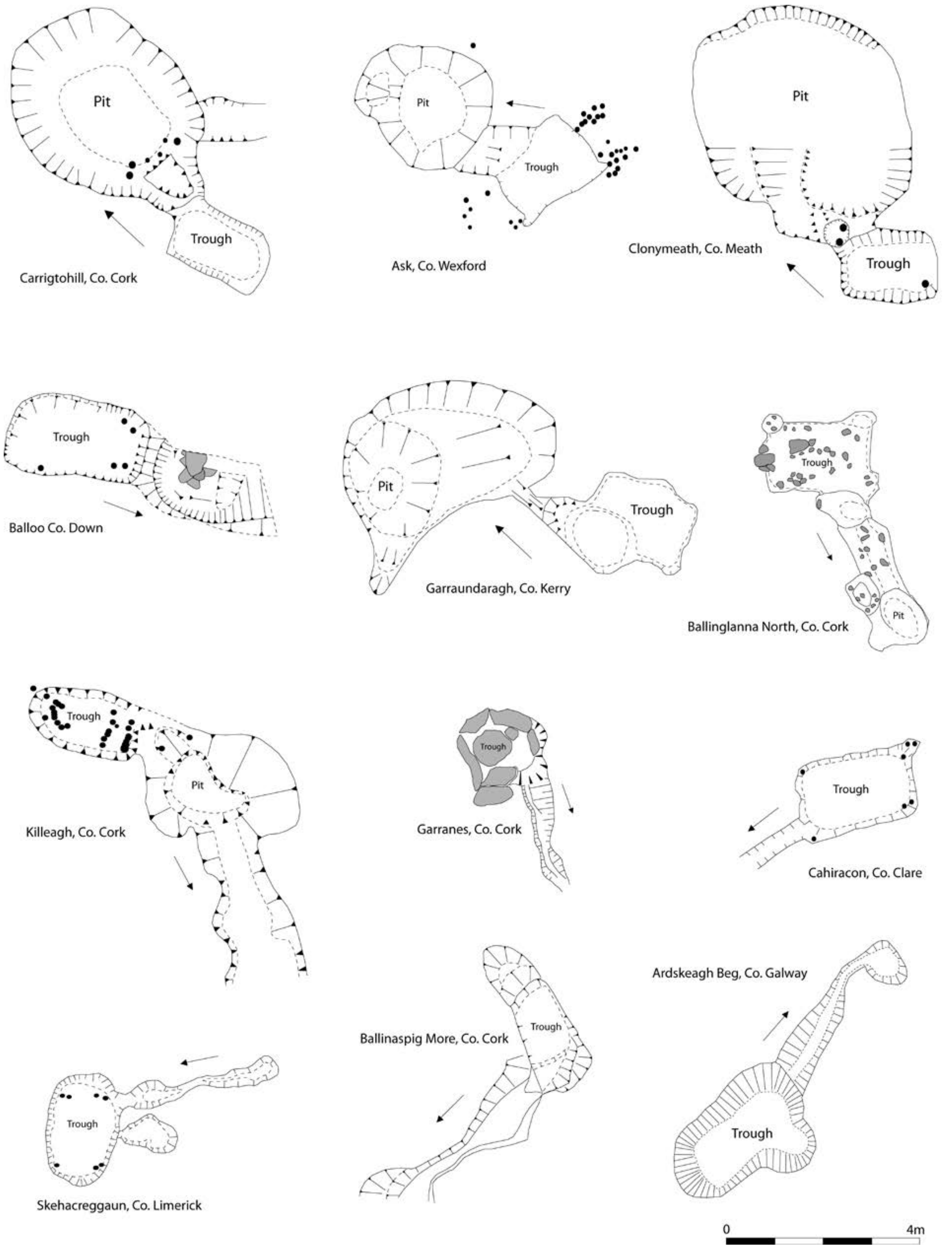

Figure 4.38. Selection of water-channels associated with excavated troughs in Ireland.

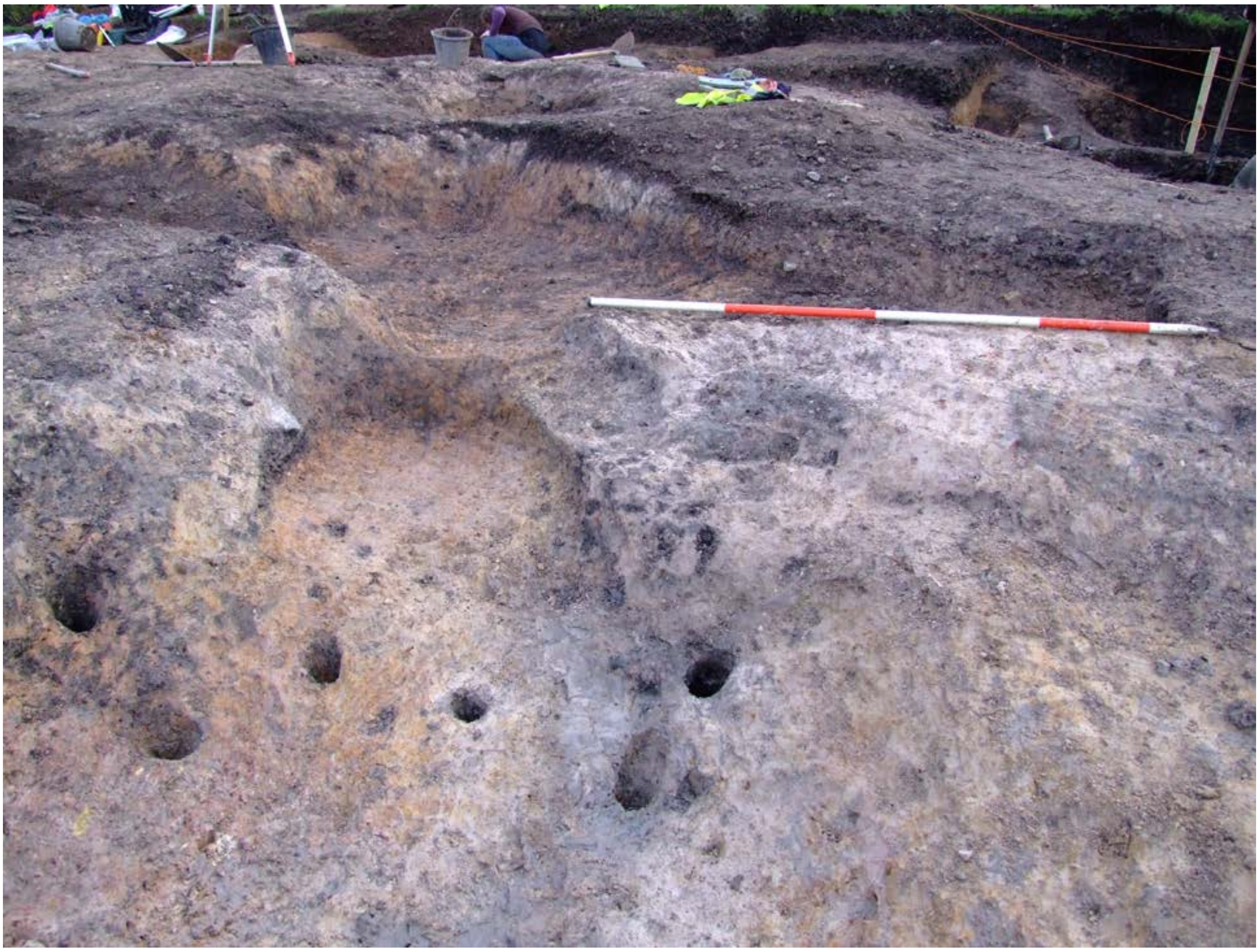

Figure 4.39. Stakehole evidence of a possible wooden sluice system designed to release water from the trough at Carrigtohill, Co. Cork. Source: Rose M. Cleary, UCC.

inlet channels due to their topographical positions. These include examples at Kilbeg, Co. Westmeath (WM35a), Ballyloughan, Co. Wexford (WX09), Ballyadam, Co. Cork (CO75), Drominycarra, Co. Limerick (LK18a), and Ballinaspig More 7, Co. Cork (CO43). In all cases this allowed rainwater to collect naturally in the trough.

Some sites are also located on ground where natural water channels are evident. For instance, the examples at Carrigatogher (Harding) and Carrigatogher (Ryan), Co. Tipperary (TY52a and TY53) were situated at the lower, more southerly portion of the excavation area where run-off from the higher ground would have naturally channelled water into the troughs (Hackett 2009b; 2009c). Larger examples at Mearspark Farm, Co. Westmeath (WM53), Ballybar Lower, Co. Carlow (CW10), and Burrow or Glennanummer (OY08), Co. Offaly probably functioned in a similar manner due to their location on a slight slope.

A number of troughs were also supplied by nearby wells, cisterns, springs or streams. For instance, at Ballyloughan, Co. Wexford (WX09), the trough was fed by a nearby former stream, which produced the remains of dumped hearth material. At Cappagh Beg, Co. Clare (CE26), an 8.7m long channel was connected to a pit or trough from a nearby stream (Grogan *et al.* 2007: 195), while a number of different water channels fed a trough at Killeagh Co. Cork (Gilligan 2010). At Kingstown, Co. Dublin (DN03), excavation revealed a trough and gully connected to an ancient palaeochannel, suggesting the former stream may have supplied the trough for water-boiling (Clinton 2002). At Gortnagroagh 1, Co. Laois (LS38), a large pit/cistern was filled by by a 12.6m long channel (Danaher 2008).

Water channels and other mechanisms associated with water management have not received the same level of attention as the more prominent features associated with burnt mounds. While these can be interpreted as basic features associated with site drainage, they reveal careful design in the siting and construction of troughs and add a further complexity to the use of these boiling receptacles.

4.7 Pits

Pits, other than those used in water troughs, are the most common feature excavated at burnt mounds. They are occasionally found in great numbers, but usually less than four examples are uncovered in any site. Out of 3271 identified pits in Irish burnt mounds, 1789 have been interpreted as none boiling troughs. In this study, pits are subdivided into a number of different types according to depth and presence of linings in an attempt

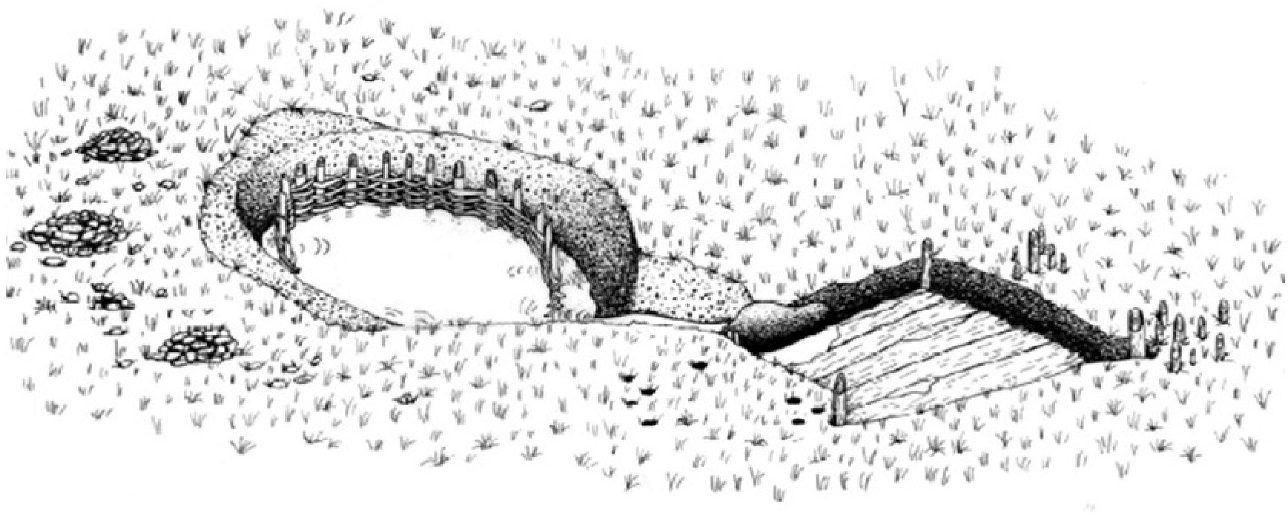

Figure 4.40. Reconstruction of trough, drainage channel and reservoir pit at Ask, Co. Wexford. Source: Bower 2010; VJK Ltd.

to determine their use for different purposes, such as the roasting of food and disposal of waste. None of these pits had organic linings to suggest they functioned as troughs, but some were deep enough to have functioned as boiling receptacles. Others contained internal stake-holes indicative of organic linings that have not survived. It is probable that all pits were not in use at the same time and may have developed over the life of a site. Backfilled pits and pits that were left open to the elements are unlikely to leave a significant surface expression over time (see Garrow 2006), and the digging of new pits in the same area was likely to have been by chance. There is no evidence to suggest surface marking of the pits, although as previously stated well-defined troughs may have been marked by the deliberate mounding of heat-shattered stone in u-shaped formations. This may explain why certain troughs are re-cut after periods of abandonment (see section 4.3 above).

Details relating to pit form suggest that the majority (70%) were circular or oval in plan, while rectangular and irregular examples account for 10% of the sample respectively (Figure 4.41). The remainder are classed as ‘other’ (4%), while the shape of 6% of pits is not recorded. The identified pits have varying dimensions and capacities. Circular/sub-circular examples range in size from 0.1-10.2m in length (average 1.3m), 0.1-9.0m in width (average 1.19m), and 0.04-2.5m in depth (average 0.35m). The average volume of circular/sub-circular pits is calculated at 0.583m³. Oval/sub-oval pits range in size from 0.2m-15m in length (average 1.6m), 0.09-15m in width (average 1.2m), and 0.01-0.60m in depth (average 0.35m). The average volume of oval pits is 0.736m³. Rectangular/sub-rectangular pits range in size from 0.16-14m in length (average 2m), 0.2-6m in width (avaerge 1.2m) and 0.03-2m in dpeth (average 0.36m). The calculated average capacity of rectangular/sub-rectangular troughs is 0.950m³.

The recorded depths range from 0.1m to 6m and are on average 0.35m deep (Figure 4.42). This makes it unlikely that the purpose of these pits was for water boiling. Furthermore, some pits, such as those found at Cloghjordan, Co. Tipperary (TY65b) were cut into natural gravel subsoil, which means they could not have been used as water receptacles (Dennehy 2006). The use of pits for storage is also questionable as just over 54 % of the pits were less than 0.3m deep and even factoring in possible truncation would have been too small. It has been suggested that these pits may have been used on a temporary basis until such time as a more permanent timber-lined trough was constructed, or else used to test the level of the underlying water-table (Ó Drisceoil 1987: 51). Some may be tree bowl/root hollows, the result of scrub/tree clearance prior to site use. This is indicated by the shallow deposits encountered at Balreask 3, Co. Meath (Hawkes 2012). Pollen studies have demonstrated that deforestation took place at a number of burnt mounds in the west of Ireland (Brown and Hatton 2004: 3).This suggest that trees and shrubs may have been uprooted deliberately during field clearance. Some 11 pits have been interpreted as modern features, while 31 others are medieval and not connected to the use of pyrolithic technology.

For those associated with burnt mound use, it has been proposed that these pits may have held shallow receptacles for organic or ceramic containers for use as pot-boilers (Grogan *et al.* 2007). However, the general lack of prehistoric pottery found in excavated examples would negate the use of such material for heating liquids. It has also been highlighted that Bronze Age pots were not robust enough to survive this type of treatment (Grogan *et al.* 2007; Seager-Thomas 2010). While some of these pits may have functioned as troughs, the insubstantial nature of others makes it unlikely that they were used as receptacles for heating liquids. While possibly connected to the use of hot-stone technology, albeit on a very small scale, the shallowness of the pits suggests a function possibly associated with roasting, baking or steaming (Figure 4.43).

A total of 73 pits display evidence of burning or are lined with stone, suggesting they may have functioned as

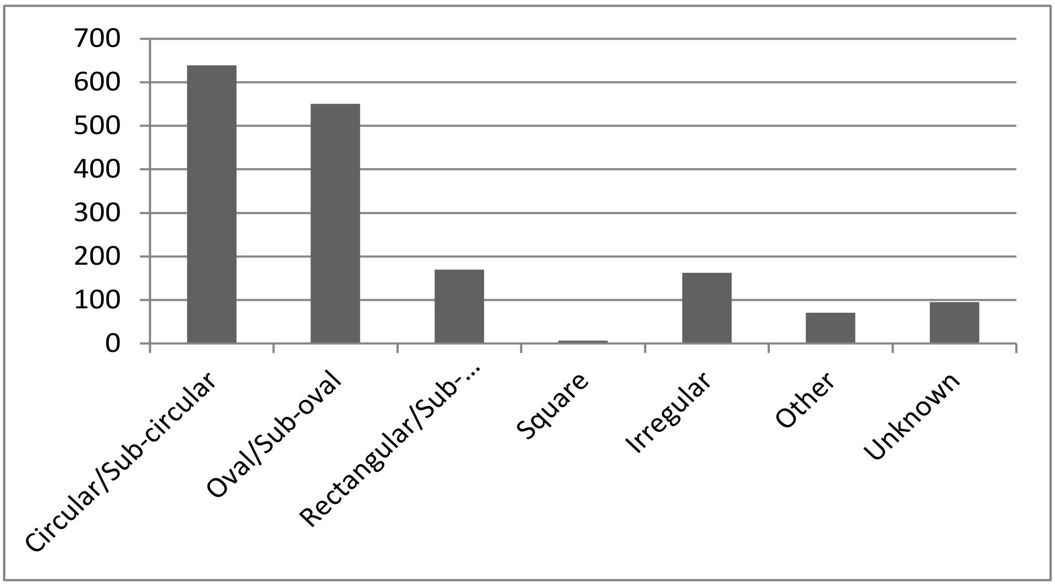

FIGURE 4.41. RECORDED SHAPE OF PITS FROM EXCAVATED BURNT MOUNDS IN IRELAND.

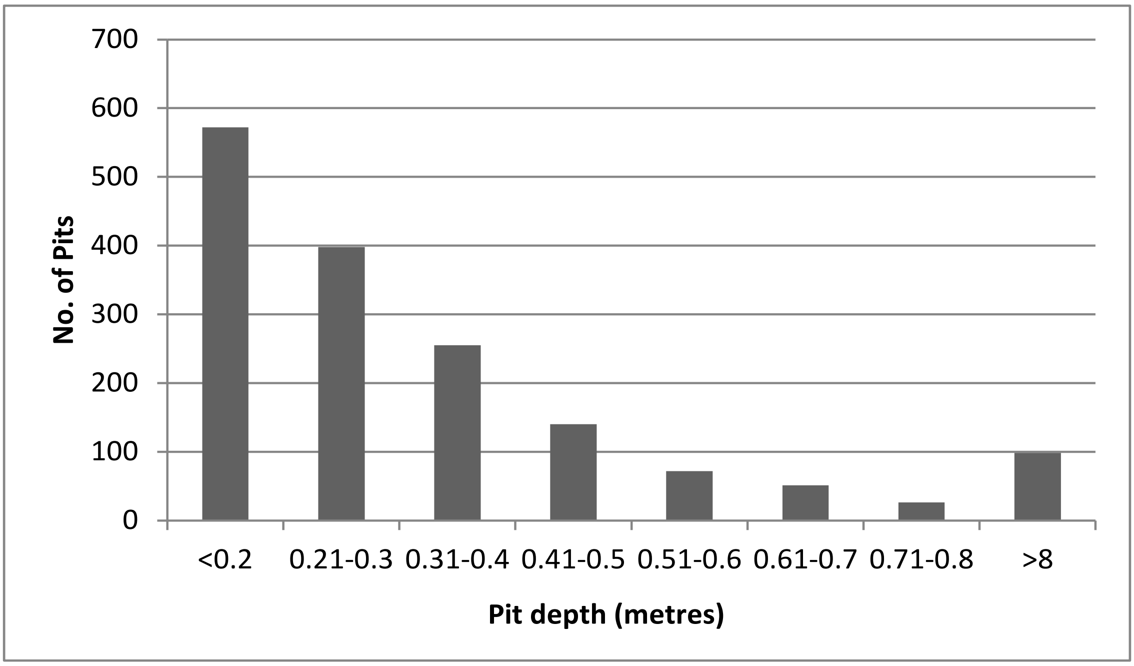

FIGURE 4.42. RECORDED DEPTH OF PITS FROM EXCAVATED BURNT MOUNDS IN IRELAND.

primitive ovens or roasting pits. These can be compared with examples encountered in other parts of Europe and Central and North America (see Chapter 3). Various ethnographic sources describe the way such methods were used to render foods more nutritious and digestible (Wandsnider 1997; Peacock 1998). The technique of prolonged cooking using hot stones in small shallow pits took several hours to complete. This generally involved an unlined pit in which hot stones were heated in situ and covered by a layer of plant material that served as a base for the food produce. Additional layers of hot stones and plant material were then added, depending on the amount of food being cooked, before being covered by earth. Alternatively, the stones may have been heated on an adjacent fire and placed into the pit separately, leaving no trace of in situ burning. A fire may also have been lit on the surface of the covered pit to expel moisture from the oven, depending on what is being cooked. However a moist environment is sometimes preferred to prevent food from burning (Toms 2008: 449). Wandsnider (1997: 14) suggests that a moist environment is needed for several reasons, the most important of which is preparing a large piece of meat. This is where the fat enables heat to permeate the tissues very rapidly and the protein is thereby quickly denatured. Steaming pits would have functioned in a similar manner to earth ovens, the only difference

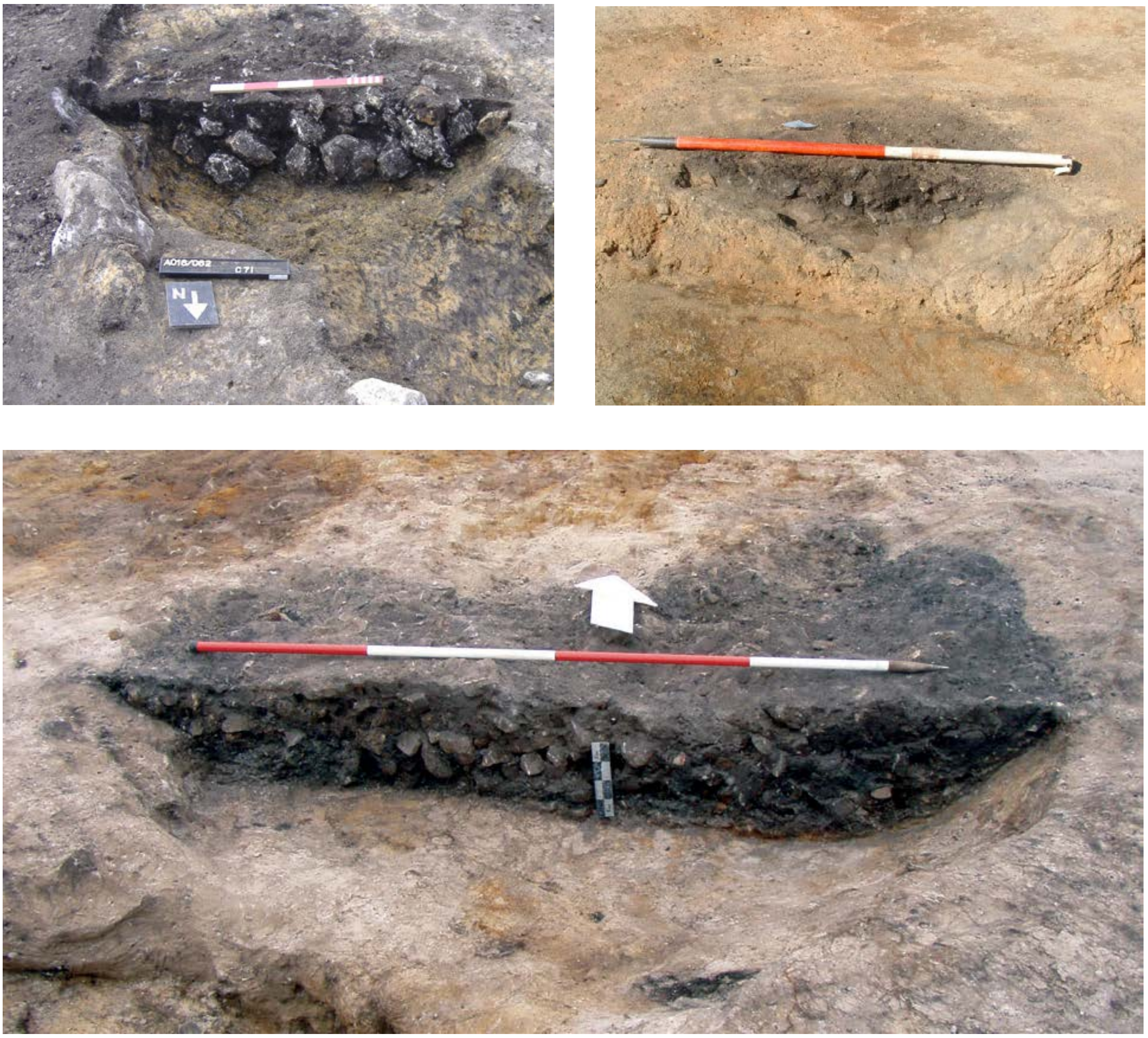

FIGURE 4.43. SELECTION OF POSSIBLE ROASTING PITS AT KILBEG 4, CO. WESTMEATH (TOP LEFT), TINNOCK LOWER, CO. WEXFORD (TOP RIGHT) AND MULLENMADOGE II, CO. MAYO (BOTTOM). SOURCE: FINTAN WALSH IAC LTD, KEVIN MARTIN FOR VJK LTD AND RICHARD GILLESPIE, MAYO COUNTY COUNCIL.

being a small prepared hole in the earthen lid where water was poured. This opening was sealed promptly to insure that steam and vapour did not escape (Thoms 2008: 450). Meat may not have been the only food produce cooked in this manner.

Thoms (2008: 445) has written extensively on the use of hot rocks in western North America, where prolonged cooking is required to hydrolyse inulin-rich roots adequately, as well as to detoxify various plant foods. Little (2015) has also remarked on the possibility that hot stones may have been used in this manner in Mesolithic Ireland, based on remains uncovered on the shores of Lake Derravaragh, Co. Westmeath (see Mitchell 1972). Plant-food remains are less durable than bone and they tend to preserve only under ideal conditions and, then, only in charred form. This may have also been a popular technique to roast certain marine resources, such as molluscs (Hawkes 2014). Archaeologically, all that remains from this process is a slightly charred pit and a pile of fire-cracked stones. Since this process does not require a large quantity of heated stones as boiling, a small fire would have been quite sufficient. The presence of in situ burning in a number of pits in Irish burnt mound sites where faunal remains have also been discovered, suggest that some were used for preparing food. Therefore, small unlined pits may have functioned as roasting or steaming pits with stakes possibly used to secure plant lining matter.

Roasting ovens were first identified in Irish burnt mounds during the excavation of Ballyvourney and Drombeg, Co. Cork (O'Kelly 1954; Fahy 1960). They were subsequently recorded in a number of burnt mounds on Clare Island, Co. Mayo, with similar examples known from several Bronze Age house sites (Gosling *et al.* 2007; W. O'Brien 2009). In total, twenty-seven pits lined with stone have been interpreted as possible roasting ovens based on their relative size in comparison with larger stone-lined troughs that fill naturally with water. Allowing for the possibility that some of these ovens may have functioned as troughs,

Figure 4.44. Stone-lined roasting pit at Ballyvourney, Co. Cork. Source: O'Kelly 1954.

the smaller pits are more likely to have functioned in a similar manner to the unlined pits, using dry heat to roast food. Some linings are fire-reddened suggesting fires were initially lighted within, allowing an additional source of heat to radiate from the side slabs before hot stones were added and the structure sealed. This was successfully demonstrated by O'Kelly (1954) at Ballyvourney where a fire was lit and left to burn for one and a half hours before being swept out (Figure 4.44). Hot stones were then piled around a joint of meat and left to cook for three hours and forty minutes. The possible oven at Leacarrow, Co. Mayo (MO03) is the only excavated example to display evidence of a possible cover stone, however these are unlikely to survive in most instances (Gosling *et al.* 2007).

While the fills of these stone ovens often contain homogenous deposits of silty clays and heat-shattered stone, some contain significant amounts of charcoal and ash. This was the case at Newtown Co. Westmeath (WM19), Cahiracon, Co. Clare (CE24) and Ballynamona, Co. Kilkenny (KK14), while raked-out charcoal and ash deposits were found adjacent to the stone oven at Ballyvourney I, Co. Cork (CO02) and at Ballyman Co. Dublin (DN01).

The roasting oven at Drombeg, Co. Cork (CO07) is unusual in that it is associated with a hut structure a short distance away from the water-boiling area (Fahy 1960). A small, slate-lined pit was found immediately adjacent to the 'oven' and interpreted as a water receptacle, however, there is no evidence to suggest this was the case. The combination of features identified here can be paralleled elsewhere, most notably at Site D at Barrees in the Beara Peninsula, Co. Cork (O'Brien 2009: 219). A large stone-built hearth and an adjacent box oevn were found in a stone built house. Although the site was not associated with a burnt mound, it was interpreted as a possible specialised hut for cooking using dry heat. Comparisons can be made with examples at Coarhamore, Co. Kerry and at Garranes, Co. Cork (Hayden 1994; O'Brien 2012a), even though the evidence for roasting activities is tentative. Therefore, it is possible the 'oven' at Drombeg functioned as an open hearth where stones were heated for the adjacent slate-lined pit. This is confirmed by the discoloured and shattered nature of slabs in the interior of stone structure from exposure to heat. In this scenario, the pit functioned as the oven and not the 'wedge-shaped' feature, as seems to have been the case at Site D, Barrees, Co. Cork.

4.8 WELLS/CISTERNS

Large, deep pits are a relatively new phenomenon at burnt mounds uncovered during recent excavations. They are often interpreted as cisterns, wells, quarry pits, waste pits or even open-air baths, and mostly date to the Middle to Late Bronze Age. Some may have had long use histories at particular sites, such as a large well at Clashnevin, Co. Tipperary dated to the Early Medieval period (Figure 4.46), or a similar feature at Ballyglass West, Co. Galway (GY31) used until the early twentieth century. Iron Age dates have been obtained from deep pits at Johnstown, Co. Meath (MH74) and Rathcash, Co. Kilkenny (KK41) where the adjacent pyrolithic activity is dated to the Bronze Age. At Ballynakelly, Co. Dublin (DN25), it is suggested that the final infilling of the well did not occur for some time after the site went out of use. This is supported by the recovery of waste metal slag and medieval pottery from the uppermost fills. As a number display evidence of being recut, the later radiocarbon dates are not surprising and indicate that these locations remained important focal points of water supply in the landscape.

These pits range in size from 1.25-14m in length (average 4.5m), 0.46-9m in width (average 3.4m), and 0.28-3.5m in depth (average 1.2m). Some large pits, such as those at Ballyadam, Co. Cork (CO75), Kellymount, Co. Kilkenny (KK56), Blanchvillespark and Foulkscourt, Co. Kilkenny (KK50 and KK29g) and Kilmainham, Co. Meath (MH94), are possibly natural ponds used as water sources (Figure 4.45). Other examples are naturally enhanced hollows, where troughs and pits were cut, such as at Busherstown, Co. Carlow (CW06) and Curraheen 4, Co. Cork (CO36).

As mentioned previously, other pits are connected to troughs via water-channels (see above). While some of these pits supplied water to the trough, others served to hold water, acting as reservoirs or emptying pits where water could be released from the trough. This arrangement of features was identified at Carrigtohill, Co. Cork (CO79), Ask, Co. Wexford (WX06), Clonymeath, Co. Meath (MH14) and Garraunderragh, Co. Kerry (KY14), where obvious water sources were not apparent. Some isolated pits have been interpreted as cisterns or water-holding features based on their relative depths and the identification of possible clay-linings. This was the case at Gortnagroagh 1, Co. Laois (LS38), Commons, Co. Limerick (LK14) and Cappaloughlin, Co. Laois (LS33). Their association with potential water inlet channels would also support the suggestion that some of these pits functioned as cisterns.

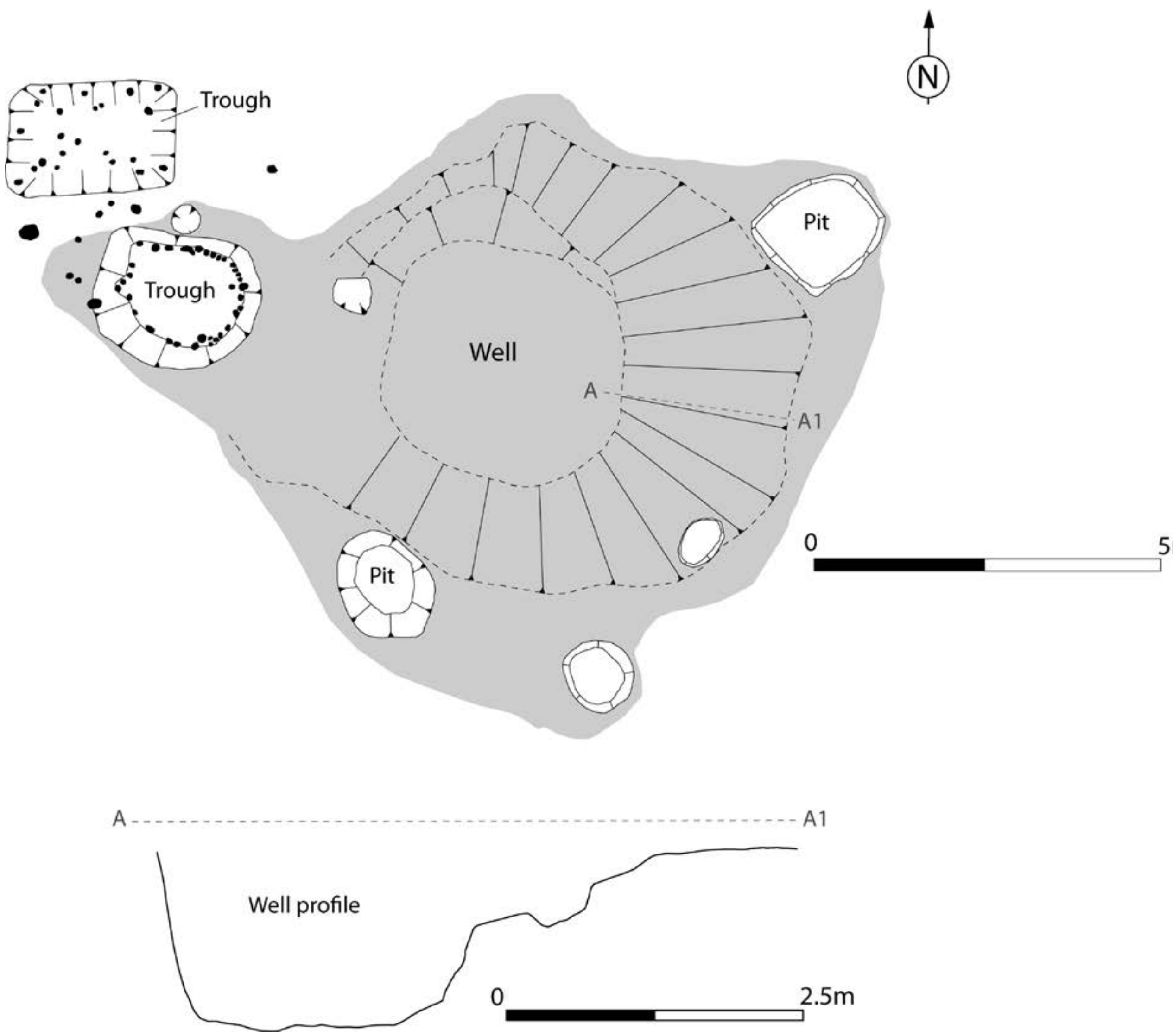

Figure 4.45. Plan and profile of well and related troughs at Kellymount 3, Co. Westmeath. Soource: adapted from Wierzbicki 2012 (IAC Ltd).

Large pits identified at Macetown, Co. Westmeath (WM47), Carricknaveagh, Co. Down (DW06) and Scrahane Co. Waterford (WD10) are interpreted as possible quarry pits for the extraction of stone for water heating processes. This is difficult to confirm as none of the pits fill naturally with water, and the presence of an adjacent water source would seemingly rule out use as cisterns for holding water. That said, the hydrology of the sites may have changed significantly since the Bronze Age, and these pits may have functioned as water retention features in periods of wet weather, collecting water for use in the troughs. However, it is unlikley water would be stored for long periods to avoid stagnation.

The size of other pits seems to be slightly excessive, with many excavated so far below the water table that they could have functioned as wells, supplying clean water in areas devoid of other sources. Furthermore, the proximity of these pits/wells adjacent to troughs was ideal in terms of water supply. A number of pits display evidence of being deliberately shaped to provide access. Some 65 examples in excavated burnt mounds can be interpreted as wells, with most located directly adjacent to a trough. Some 17 are connected via water-channels, either supplying the trough with water as at Cuffsborough, Co. Laois (LS33), or serving as a drainage outlet as at Balloo, Co. Down (DW10c) and Ballyglanna North, Co. Cork (CO71). Ramps, wooden platforms and stone surfaces are occasionally found around these features, while several pits display stepped profiles that emphasise the complexity of these sites and the importance of access to clean water for boiling.

At Kilmainham I, Co. Meath, a 0.9m long row of six or seven oak posts were driven into the peat and underlying clays in the eastern half of a natural pond. These posts were associated with a number of horizontal split wooden planks that may have been the basis for an access ramp to the pond (Walsh 2009b). Stake-holes recorded at sites such as Clogh East, Co. Limerick (LK39) and Johnstown, Co. Meath (MH74) have been interpreted as supports for possible handrails for accessing well pits (Figure 4.47).

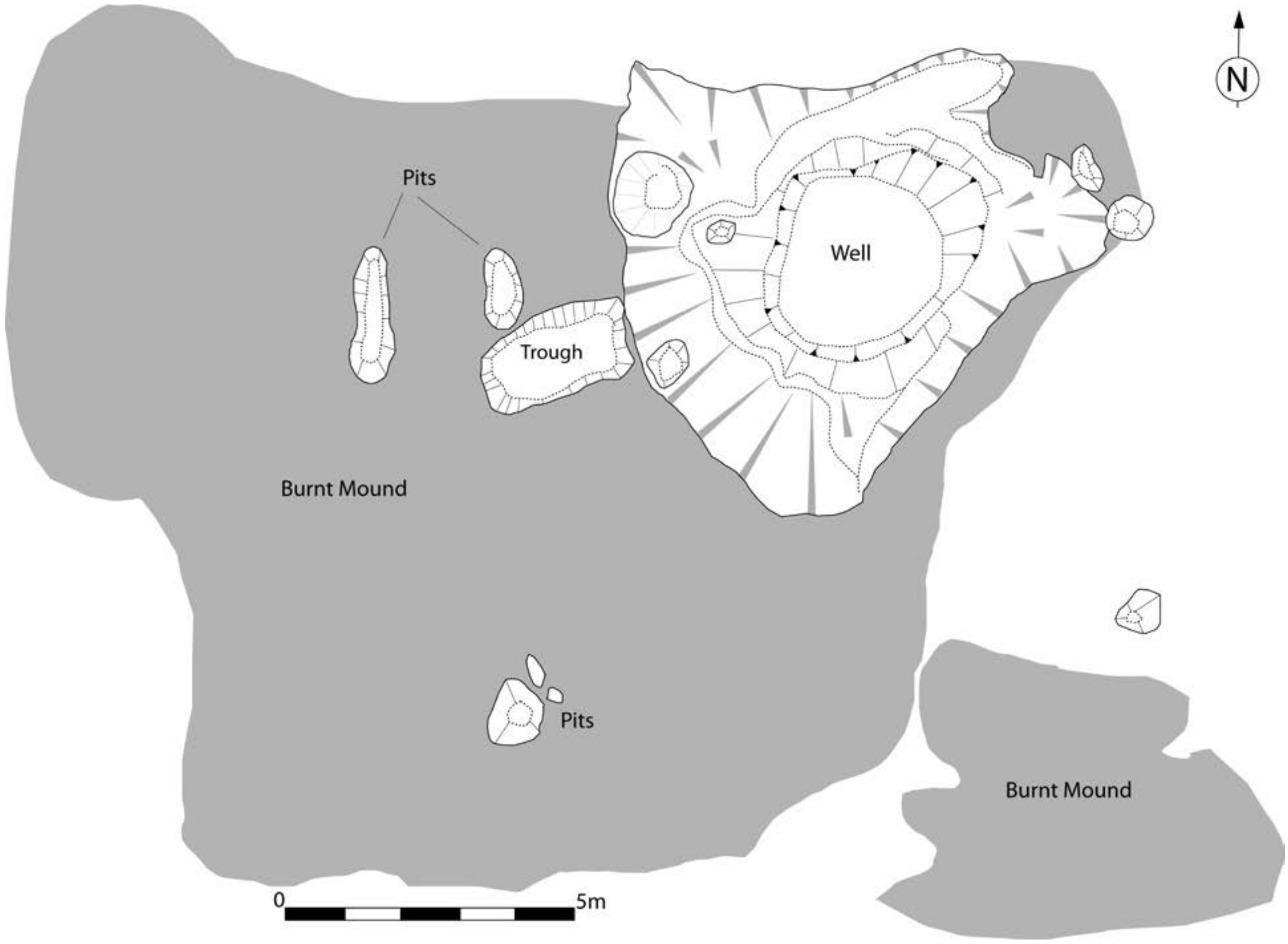

Figure 4.46: Post-excavation plan of well, troughs and pits at Clashnevin 1, Co. Tipperary. Source: Redrawn from Kiely and Moran 2011 (Eachtra Archaeological Projects).

The remains of a possible Late Bronze Age ladder was uncovered in the base of a pond at Owen's and Bigg's-Lot, Co. Tipperary (Hughes 2008: 33). The stepped bases may have been for use at periods of low water, since at other times they would have been submerged. Similar features were observed at Late Bronze Age wells at Swalecliffe in Kent (Masefield *et al.* 2003: 105). At Perry Oaks, London, two basic forms were identified. One type was steep or vertical sided, which would have required people to draw water either by buckets or by climbing into them on log ladders, some of which were partially preserved. The second type had a shallow ramped access on one side (Lewis and Batt 2006: 133).

One of two large pits excavated at Ballyburn Lower, Co. Kildare (KD16) on the N9/N10 Kilcullen to Waterford Road Scheme was supplied water by a channel (Hackett 2009d). The larger of the two pits was surrounded on one side by a series of stake-holes suggesting that the feature may have been covered in some way. The pit had a large stone-lined basin at its base that may have formed the floor of a structure interpreted by Hackett as a 'bath house'. In this scenario an individual would have been partially submerged in hot water in addition to steam being retained in the structure (Hackett 2009d: 11). A large pit excavated at Camlin 3, Co. Tipperary (TY69) was interpreted in a similar manner, but in that case, an open-air water bath was likely preferred (Roycroft 2008: 35).

Many of these interpretations seem implausible due to the relative depths of the pits and the volume of stone needed to heat the water. The fact that the majority of these pits filled naturally with water made regular emptying of fired debris almost impossible. Similar sized pits at Clogh East and Commons Little, Co. Limerick (LK39 and LK42) were unsuitable for heating purposes due to their substantial depths (Grogan *et al* 2007: 95). There is also no substantiating evidence that any of these were roofed. Post and stake-holes uncovered in proximity to a large pit at Camlin 3, Co. Tipperary (TY69) and were interpreted as the remains of a possible shaduff or water-lifting crane (Roycroft 2008: 35). This explanation is purely speculative and no other structural evidence survived in the pit to support such a claim. Water heating may instead have only taken place in the surrounding pits, and the burnt stone within the large pit may represent deliberate or accidental dumping of waste from this activity.

Preserved plant remains have been recovered from a number of excavated well pits including Kennastown 1, Meath (MH77); Williamstown or Bawn, Co. Meath (MH71); Johnstown, Co. Meath (MH74); Ballynakelly, Co.

Figure 4.47: Plan and profile of well and related features at Clogh East, Co. Clare. Source: adapted from Grogan *et al.* 2007.

Dublin (DN25); Cuffsborough, Co. Laois (LS33 and LS34); Coolfin 3, Co. Laois (LS28), and Lusk, Co. Dublin (DN22) (ASDU 2007; 2008; Schmidle *et al.* 2009; Lyons 2009). This can reveal much about the site and local environments during the use period of the adjacent water-heating facilities. Among the wild plant remains identified are buttercup, goosefoot, fat-hen, knotgrass, campions, sheep's sorrel, curly dock, dock, bramble, dead nettle, stinging nettle, elder and sedge (Lyons 2009). These wild taxa reflect an open scrub and hedge flora that commonly grows at the margins of woodlands and around settlement sites. Hazel nutshells and seeds of hawthorn, raspberry, blackthorn, sloes, elder and bramble are also particularly abundant giving some indication of the nearby scrub vegetation. Along with producing edible nuts or fruits the local scrub and woodland would have been an important source of wild foods, in addition to providing wood for fuel. Ruderal taxa, such as redshank, knotgrass, prickly sow-thistle, common chickweed and nettle, are likely to have grown on areas of disturbed ground near the site, while sedges and ragged robin would have favoured wetland habitats (Lyons 2009). Grasses, selfheal, buttercups, docks, woundwort and violets are species with wide ecological niches, which may have occupied various woodland, wetland or ruderal habitats near the site. There is usually no indication that this material was purposefully used or deposited and it is more likely they are natural accumulations that entered the wells via watercourses or rainwater.

It is widely acknowledged that watery environments had special significance in people's lives during the late prehistoric period (Bradley 1998; Bradley and Gordon 1988). In addition to providing the essential requirements for water-boiling, the spatial distribution of water-holes/wells and the artefacts recovered in some, suggest a historical and probably spiritual link with the past and its ceremonies and rituals. Ritual activity has been hypothesised for some of the aforementioned wells (Grogan *et al* 2007: 95) due to deliberate backfilling and the presence of artefacts. A carved wooden object from Cuffsborough, Co. Laois (LS34), was found in the fill of a possible well (Murphy and Kane 2008), while an Iron Age bucket was retrieved from the base of a large Middle Bronze Age pit at Clonee, Co. Meath (McCarthy *et al.* 2009). A Middle Bronze Age palstave was found in the base of a pit at Ballynakelly, Co. Dublin (DN31) (McCarthy 2010). Deposits of animal remains have also been interpreted as being deliberately placed in these

features. Vertebrae and skull fragments found in the base of a large pit at Arbraccan, Co. Meath (MH63) would have effectively ended any use of the pit as a drinking supply (Mossop and Ruddle 2009). The intact skull of a large cow was recovered from the base of a well at Rath, Co. Meath (MH26) (Schweitzer 2009), while a complete human skull of an adult male was found deliberately placed in the bottom of a spring at Inchagreenoge, Co. Limerick (LK46) (Taylor 2003). Deliberate deposits have also been noted in burnt mound wells outside of Ireland, at sites such as Swalecliffe in Kent. Here, a large upturned ceramic vessel was found in the base of a large well. It was interpreted as an offering, possibly in an attempt to increase water levels in the pit (Masefield *et al.* 2003: 114). A large waterhole adjacent to a burnt mound at Reading Business Park also produced an array of artefacts, including the remains of a possible cheese press and bone disc worked from a human skull (Brossler *et al.* 2004: 124).

The use of wells or man-made pools for votive deposition is widely known from various parts of Europe during the Bronze Age (Coles and Harding 1979). A deep well or shaft at Wilsfold, Wiltshire, produced offerings from a number of levels, with dates from 1880–1410 BC (Ashbee 1963). Later Iron Age votive pools and wells are also found on some mainland European *viereckschanzen* sites. These were deep pits that may have been used for offerings, a good example being Holzhausen near Munich in Germany (Kock 2006: 938).

4.9 STONE PATHS AND TIMBER TRACKWAYS

The discovery of trackways at burnt mounds is rare as they are often truncated or disturbed by later activity. It is also difficult to determine whether they are connected to a particular feature or contemporaneous with the water-boiling activity, as many are undated or not fully revealed during excavation. Only 25 sites in the present study had evidence for the existence of paths or trackways, seven of which were of stone, while 16 were constructed with brushwood or planks secured by stakes (Figure 4.48). One example at Erris, Co. Roscommon (RM02) had evidence of both stone and timber materials being used.

Bronze Age trackways have been found in large numbers in Ireland, particularly from raised bogs, at locations such as Corlea and Derroghill, Co. Longford (Raftery 1996). Trackways constructed of planks, brushwood, hurdles and stone have also been uncovered at Lisheen, Co. Tipperary (Cross May *et al.* 2005) and more recently along various road developments such as the N25 Waterford Bypass (Eogan and Shee-Twohig 2011) and the N4 Dromod–Roosky Bypass (Moore 2008). During the Middle Bronze Age, areas of wetland began to be occupied with the result that different settlement territories were connected by toghers or trackways. Although the settlement landscape was largely based on permanently occupied and dispersed farmsteads, there may have been some local element of settlement mobility or seasonal movement of cattle herds (O'Sullivan 1997: 71). The seasonal use of burnt mounds may have required the building of timber and stone trackways to cross areas of bog and to move livestock.

Three of the timber platforms identified at burnt mounds are composed of planks, sometimes held in place by pegs. At Coolfin, Co. Laois (LS28), a large well was associated with a series of tangentially split alder planks, as well as one radial split oak plank, laid one over the other. Posts associated with the track were also split and were constructed from alder wood (Danaher and Kane 2008). A 7m long arrangement of similarly split planks were interpreted as a possible trackway at Ballynamona, Co. Kilkenny (KK13), while at Newtown, Co. Dublin (DN23) a peat basin adjacent to the burnt mound contained three large split oak planks lying parallel to each other. These may have been deliberately laid to access water for the trough (Schweitzer 2008).

The remaining trackways were composed of brushwood and other timber elements placed lengthways, including examples at Kiloteran, Co. Waterford (WD16), Inchagreenoge, Co. Limerick (LK45b), Deepark East, Co. Mayo (MO20), Attireesh, Co. Mayo (MO24), Gortaroe, Co. Mayo (MO27) and Killescragh, Co. Galway (GY19). A system developed by the Irish Archaeological Wetland Unit has classified these as 'tertiary toghers' defined as short stretches of reasonably well structured trackway, laid down to cross a localised area of wetland (Moore 2008: 2).

A trackway at Killescragh, Co. Galway (GY19), is the longest example with a recorded length of 19m. This arrangement of brushwood and roundwood meandered towards the nearby stream, suggesting that the purpose of the track was to provide a dry surface from which to access a water source. A possible brushwood trackway at Mullamast, Co. Kildare (KD21), seemed to be deliberately placed across a stream bed in order to access the site. The brushwood trackway at Deerpark East, Co. Mayo (MO20) was directly associated with the trough at the site, with parallels at Attireesh Co. Mayo (MO24). In some cases, however, a direct association is not clear, especially if sites exhibit a number of difference phases of use. For instance, the portion of brushwood trackway identified 4m north-west of the trough at Kiloteran, Co. Waterford (WD16) is dated to the Middle Bronze Age, considerably later than the water-boiling activity in that site. Similarly, charcoal from the trackway at Killscragh, Co. Galway (GY19) is dated to the Late Bronze Age and also represents a separate phase of activity. It has been suggested that this trackway availed of the dry area created by the mound, using the latter as a starting point from which to access the wetland to the south (Bermingham 2009: 27). A similar situation is known from the raised bog at Derryville, Co. Tipperary (Cross May *et al.* 2005). The brushwood and roundwood trackway at Killoran, Co. Tipperary (TY03), ended within marginal woodland fringing the bog. This 1m long trackway extended from the woodland across a wet area and on top of the earlier burnt mound. It appeared that the burnt mound had gone out of use prior to construction of the trackway dendro-dated to 1547±9 BC. It can be suggested that these examples do not represent

CAT. NO	TOWNLAND	COUNTY	STONE	TIMBER	L (M)	W (M)
WD10	SCRAHANE	WATERFORD	Y		12	2
WD16	KILOTERAN	WATERFORD		Y	5	2
WD22B	BALLYDUFF EAST	WATERFORD	Y		8	6
LK45B	INCHAGREENOGE	LIMERICK		Y	2	3
LK55	RINCULLIA	LIMERICK	Y		10	15
RM02	ERRIS	ROSCOMMON	Y	Y	5.5	1
MO20	DEERPARK EAST	MAYO		Y	6	0.16
MO24	ATTIREESH	MAYO		Y	7	1.5
MO27	GORTAROE	MAYO		Y	6.2	2.2
KY09	COOLGARRIFF	KERRY	Y		2.6	1.9
KY18	DROMORE	KERRY		Y	-	-
LS28	COOFLIN	LAOIS		Y	-	-
GY19	KILLESCRAGH	GALWAY		Y	19	1.8
GY19	KILLESCRAGH	GALWAY		Y	5.7	2
KK13	BALLYNAMONA	KILKENNY		Y	7.23	1.7
KK13	BALLYNAMONA	KILKENNY			7	-
KK49	BALLYKEOGHAN	KILKENNY	Y		19	-
CO07	DROMBEG	CORK	Y		8	1
CO02	BALLYVOURNEY I	CORK	Y		3	-
KD21	MULLAMAST	KILDARE		Y	2.3	1
KD38	PRUMPLESTOWN LOWER	KILDARE		Y	-	-
MH63	ARDBRACCAN	MEATH	Y		14.5	2
TY02	KILLORAN	TIPPERARY		Y	13	1
TY03	KILLORAN	TIPPERARY		Y	7	3.5
CE47	CAHERAPHUCA	CLARE		Y	-	-
DW02	DUNMORE	DOWN	Y		5	-
WM41	KILBEG	WESTMEATH	Y	Y	5.7	-
KK17	RATHPATRICK	KILKENNY	Y		-	-
MH26	RATH	MEATH	Y		-	-

FIGURE 4.48: LIST OF EXCAVATED BURNT MOUNDS WITH EVIDENCE OF TRACKWAYS IN IRELAND.

CAT. NO	SITE	COUNTY	L (M)	W (M)	STAKES	DATE
CE05	KILLULLA	CLARE	1.15	1	YES	NO
GY18	KILLESCRAGH	GALWAY	1.7	1.3	YES	1394–1132 BC
LS33	CUFFSBOROUGH	LAOIS	3.09	2.15	NO	NO
MO47	SONNAGH	MAYO	1.7	0.8	YES	NO
KK23A	ISLANDS	KILKENNY	1.44	0.58	NO	1130–910 BC
WM49A	BALLYKILMORE	WESTMEATH	1	0.5	NO	NO
KD19	MULLAMAST	KILDARE	1.35	0.9	NO	2130–2080 BC
LH22	FAUGHART LOWER	LOUTH	1.1	0.9	NO	1390–1120 BC
WW41	BALLYCLOGH NORTH	WICKLOW	2	1.42	NO	1420–1200 BC
WW41	BALLYCLOGH NORTH	WICKLOW	2.1	1.24	YES	1400–1050 BC

FIGURE 4.49: POSSIBLE WOODEN PLATFORMS IDENTIFIED FROM EXCAVATED BURNT MOUNDS IN IRELAND.

undertakings of any great scale, and were probably built in a short period of time, possibly when the site surfaces became unstable due to waterlogging.

Eight examples of stone pathways have been identified, with two short examples possibly representing working surfaces or platforms. The walkway at Scrahane, Co. Waterford (WD10), is composed of a heavily compacted burnt stone layer that may not represent a stone path leading to the site. At Erris, Co. Roscommon (RM02), wood was used in conjunction with stone, possibly used as a foundation for the stone surface. Similar construction methods were recorded at Kilbeg, Co. Westmeath (WM41). Even though stone has the advantage of durability, heavy paving will not easily hold together in wet terrain and so may have been avoided.

While the tertiary trackways were used to access water and to create a firm footing in waterlogged areas, some stone pathways may indicate a division of space within the working area of site. At Rincullia, Co. Limerick (LK55), the natural limestone bedrock was utilised as a pathway that linked the burnt mound to a series of possible roasting pits (Dennehy 2003). At Drombeg, Co. Cork (CO07), an 8m long pathway connected the water-boiling area to a hut structure (Fahy 1960), while at Ballyvourney, Co. Cork (CO02), a number of stepping stones connected the trough to a small timber-framed structure defined by a series of stake-holes (O'Kelly 1954). At Attireesh, Co. Mayo (MO24), a stone pathway linked an ancient shoreline to the trough. A compacted cobbled surface ran from a trough at Ballykeoghan, Co. Kilkenny (KK49), to nearby palaeochannel. At Rath, Co. Meath (MH26), a stone path connected a possible sweatlodge structure to a nearby water-source. Such pathways correspond to working areas that were frequently used and therefore required more substantial reinforcing.

4.10 Platforms and working surfaces

Platforms and working surfaces at a number of excavated burnt mounds are often found adjacent to the trough (Figure 4.49; Figure 4.50). They are usually interpreted as surfaces laid down in boggy terrain to provide a firm footing for those using the site. The movement of people around a site would have made for muddy ground conditions in these boggy locations. This was often addressed with wooden planks or stone slabs, sometimes referred to as 'kneelers' (O'Brien 2012a; Dennehy 2008). Deliberately laid paving slabs have been uncovered at five burnt mounds in Ireland, all dating to the Middle to Late Bronze Age. These stone slabs surround the immediate trough area, while flat timber planks at Cahiracon (CE22) and Killoran (TY03) served the same purpose. Paving slabs have been identified at a number of Scottish burnt mound sites associated with stone-lined troughs (Dockrill *et al.* 2007). More substantial stone and timber surfaces are also found and, in some cases, the waste fired-material was used as a surface from which to access areas. This was possibly the case at Scrahane, Co. Waterford (WD10), Coonagh

Figure 4.50: pre-excavation of stone trough and associated stone kneeler/platform at Dromnea, Co. Cork. Source: Rose M. Cleary UCC.

West, Co. Limerick (LK60) and Burrow or Glenanummer, Co. Offaly (OY07). At some sites, considerable amounts of clay were deliberately imported and used as a platform for the construction of troughs. For example, at Errew, Co. Leitrim (LM12a-c), three separate clay platforms were constructed in a wet environment in order to provide a dry area on which to carry out a water-boiling process (Pétervàry 2007).

A number of deliberately laid timbers have been interpreted as possible platforms for activities carried out at these sites. In some cases, it seems more likely that these represent the remains of truncated troughs where only the base of the feature survives. This is further supported by the identification of supporting stakes placed at the corners, as at Killulla, Co. Clare, Killescragh, Co. Galway, Sonnagh, Co. Mayo and Ballyclogh North, Co. Wicklow (Figure 4.51; Figure 4.52). These features are common in Late Bronze Age troughs and were used to support timber side walls (see above).

At Killescragh (GY18), Sonnagh (MO47), Islands (KK23a), Ballykilmore (WM49) and Mullamast (KD19) the 'platform' features seem to be latter additions to the site as they are placed on earlier burnt mound material. Radiocarbon dating established that they are not contemporary with other features on site. For instance, at Sonnagh, Co. Mayo (MO47) the platform was stratigraphically later than the adjacent trough is it lay on a 0.3m thick layer of mound material (Gillespie and Kerrigan 2010: 67). At Mullamast, Co. Kildare (KD19), radiocarbon dating has shown that the platform is some 250 years later than the dates returned from the burnt mound material and timber trough. Similar situations were confirmed at Islands, Co. Kilkenny (KK23a) and Killescragh, Co. Galway (GY18). With average dimensions of 1.6m by 1m, the 'platforms' are more comparable to trough measurements (see above) and can be interpreted as the truncated remains of such features. The identification of a 'platform' overlying a natural spring at Ballykilmore, Co. Westmeath (WM49) supports this interpretation, as troughs are often deliberately positioned over natural water sources.

Figure 4.51: Roundwood-lined trough and possible platform (foreground) at Sonnagh 1, Co. Mayo. Source: Richard F. Gillespie for Mayo County Council and Transport Infrastructure Ireland.

Figure 4.52: Possible timber platform at Coolacork, Co. Wicklow. Source: Yvonne Whitty for IAC Ltd and Transport Infrastructure Ireland.

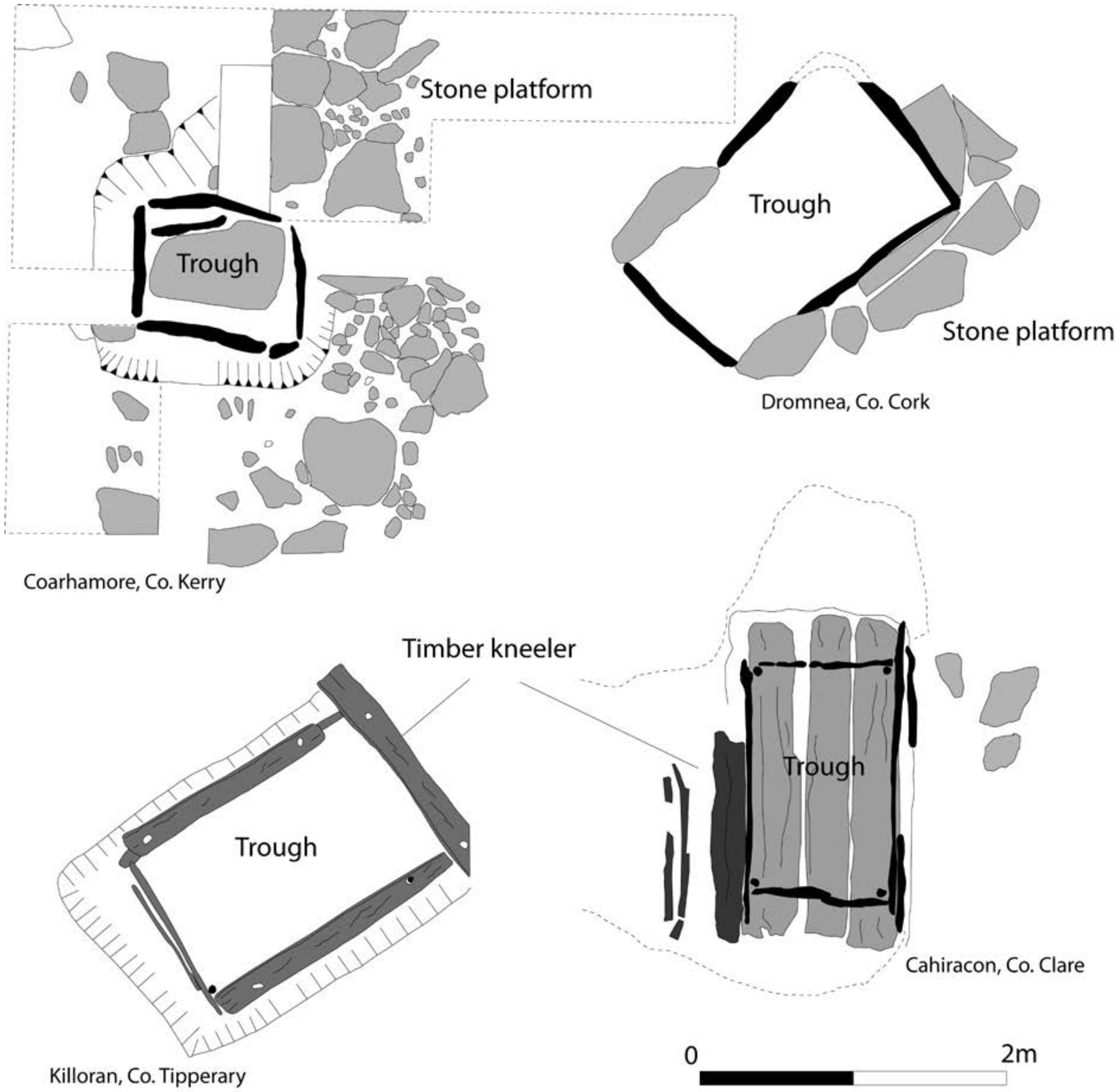

Figure 4.53: Selection of stone and timber trough kneelers/working surfaces from excavated burnt mounds in Ireland. Source: adapted from Sheehan 1990: Cleary 1986: Cross-May 2005 and Grogan *et al.* 2007.

Other timber platforms are more clearly associated with the activities carried out in burnt mounds. A brushwood platform at Moher, Co. Leitrim (LM07) was directly adjacent to the trough, while a similar platform at Clare, Co. Mayo (MO15) was connected by a deliberately laid tree trunk that led from the trough. At Killoran, Co. Tipperary (TY04) a stone and timber platform was revealed adjacent to the remains of a trough, while timber platforms were found associated with a number of wells or springs at Annaholty Co. Tipperary (TY46), Busherstown, Co. Carlow (CW06) and Tinryland, Co. Carlow (CW07).

Stone metalled surfaces have been uncovered at 34 excavated sites dating from the Early to Late Bronze Age periods. These surfaces are usually composed of small unburnt stones compressed into the natural subsoil and are always located close to troughs and wells to provide a stable surface from which to access those features. They can range from small compacted areas around two metres square to very large deposits extending 19m across overthe entire working area of the site. Only at Rathpatrick, Co. Kilkenny (KK17), is the cobbled surface not obviously associated with a trough; however, the full extent of that surface was not revealed by excavation. At Cahiracon, Co. Clare (CE22), an unburnt stone deposit was deliberately placed in the trough during a separate phase of activity. This reduced the size of the trough and provided a 'kneeler' for the pit (Figure 4.53). Butchered animal bone has been recovered from a number of these surfaces, such as Hughestown, Co. Roscommon (RM03), Killescragh, Co. Galway (GY18) and Killulla, Co. Clare (CE05). At Burrow or Glenanummer, Co. Offaly (OY07), butchered

animal bone was recovered from a compacted burnt stone platform revetted by a number of timber planks. This platform was separated from the trough, suggesting it may have functioned as an area for the slaughter and butchery of animals. The larger metalled surfaces at a number of burnt mounds may imply a communal use, or at least, the presence of small groups to work and maintain these boiling pits. In most cases the surface area of a pyrolithic site was wet and therefore soft under foot , which explains the construction of metalled surfaces and other water management features such drainage channels.

4.11 ANCILLARY STRUCTURES

The first hut structure identified at a burnt mound in Ireland was excavated at Ballyvourney I, Co. Cork (O'Kelly 1954; Figure 4.54). A roughly oval structure, measuring 5m by 6m, was defined by a series of stake-holes. This flimsy hut was connected to the water trough area by a series of stepping stones, indicating that it was associated with the water-boiling activities. Similar stake-built structures were revealed at the nearby site of Ballyvourney II, and at Ballycroghan, Co. Down (O'Kelly 1954; Hodges 1955). It was not until the excavation of Drombeg, Co. Cork that evidence for more substantial built structures was uncovered (Fahy 1960). At that site, two basic building practices were identified; one in timber, the other in stone (Ó Drisceoil 1980: 56).

These structures were usually interpreted as either temporary hunting shelters or meat stores in light of the historical references to huts as '*fianboth* or *(f)uarboth*,' used by the mythical band of warriors known as Fianna. The literary sources suggest a structure of a temporary nature, associated with outdoor life and cooking. Elsewhere, they are described in the context of hunting or armies on the march, setting up temporary encampments, in which the fianboth was an essential structure (*ibid*.: 151).

While built structures were initially regarded as a regular component of Irish burnt mounds (*cf*. O'Kelly 1954), they are now seen as uncommon relative to the large number of sites excavated in the modern era. That said, factors relating to preservation and site investigation should be considered. Equally, the majority of early excavations were conducted under research conditions where sites were largely intact. It is possible that waterlogged conditions at many sites prevented the building of structures from taking place in the immediate vicinity of troughs. Ó Néill (2009: 132) identified 18 built-structures directly associated with burnt mound deposits. The current study has identified

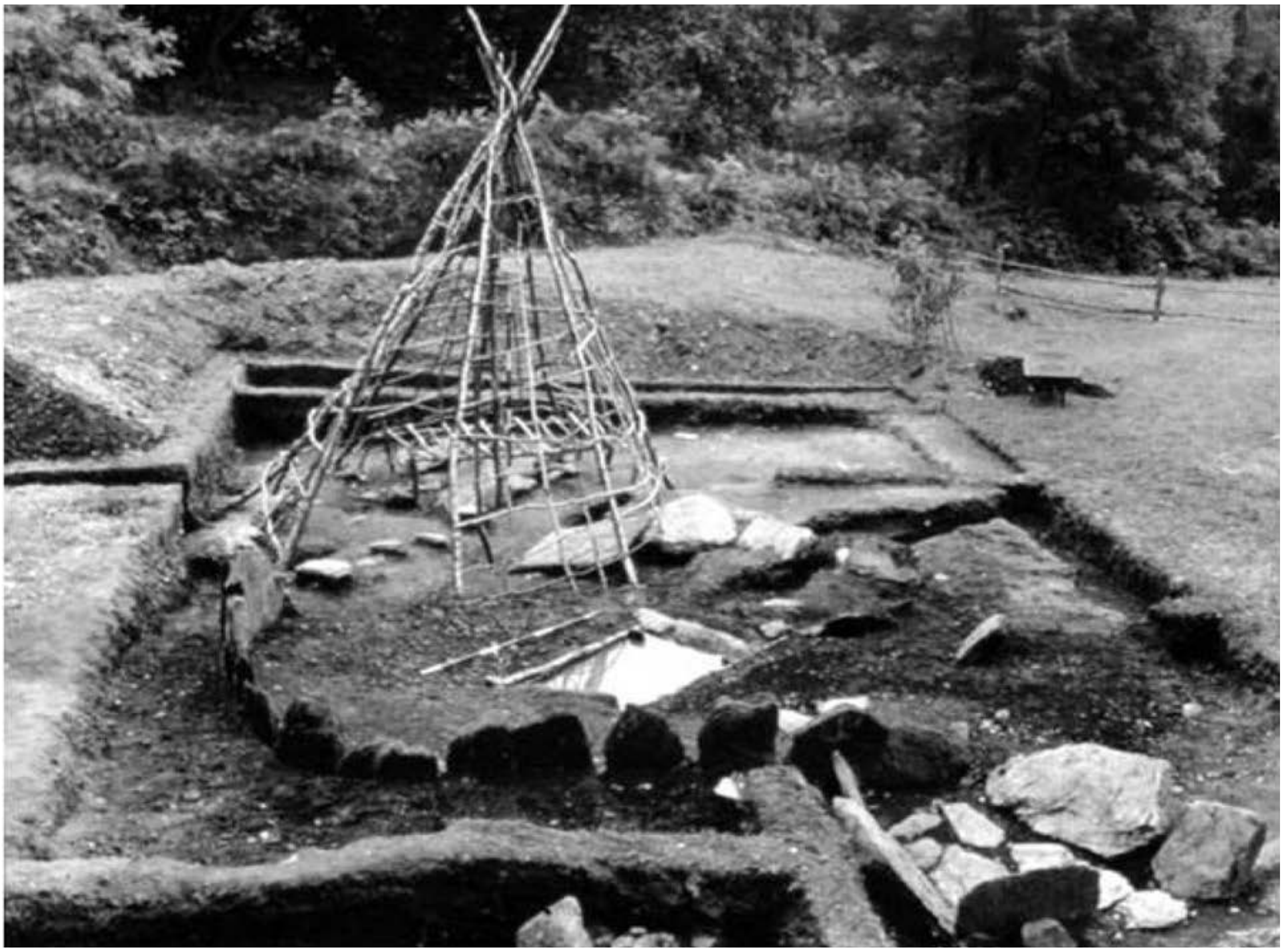

Figure 4.54: Reconstructed hut and trough from excavations at Ballyvourney I, Co. Cork. Source: O'Kelly 1954.

an additional 53 examples, bringing the total to 69 sites across Ireland (Appendix 1: Figure 10.6).

All of these structures represent timber buildings, with only one example at Kilbeg, Co. Westmeath, associated with a possible stone foundation or footing (McManus 2009). Four basic ground plans can be deduced from the archaeological evidence, within which there is considerable diversity in form and size (Figure 4.55; Figure 4.56). The most common ground plan identified in the study were circular examples, which account for 45% of the evidence. Rectangular structures account for 20%, 4% are square, while 31% are either of a U-shape or oval form. For the most part these structures are small, often consisting of circular arrangements of stake-holes or post-holes, with seven sites displaying evidence of slot trenches. Of these, only Scartbarry, Co. Cork (CO54); Faugart Lower, Co. Louth (LH23); Gardenhill, Co. Limerick (LK67); Baysrath, Co. Kilkenny (KK34), and Blanvillespark, Co. Kilkenny (KK51), may have been constructed of plank walls (Hurley and Hanley 2013; Delaney 2009; Scotland 2010; Walsh 2011; Coughlan and Bailey 2011). The structures identified at Caltragh, Co. Sligo; Derver 4, Co. Meath; Clonmore North, Co. Tipperary; Cloghers, Co. Kerry; Philpotstown, Co. Meath, and Cherrywood, Co. Dublin, can be compared to the hut structures found in Bronze Age settlement sites (Danaher 2007; MacQuade *et al.* 2010; Kiely 2010). The remaining structures were constructed using 'free-standing' rows of post or stakes and are small, generally not exceeding 3m in length by 2.5m in width. The definite hut structures excavated at burnt mounds range from very small examples with an internal area of *c.*1m², such as Gransha, Co. Derry (DY02; Chapple 2008), to larger examples similar to those found at contemporary settlement sites with internal areas up to c.90m². These larger examples, while located close to the working area of burnt mounds, are situated on more elevated drier areas as one would expect. Three main structure types associated with pyrolithic technology can tentatively be identified from the archaeological evidence. These include trough structures (Type A), sunken pit structures (Type B) and light tented structures (Type C).

Shape	Dim	L(M)	W(M)	Av (L)	Av (W)	Area M²
Rect	Min	1.05	0.87	3.1	2.3	8.57
	Max	8	4			
Oval	Min	1.64	1.64	3.9	2.9	43.22
	Max	8	7.5			
Circular	Min	1.5	1.5	4.7	4.5	76.52
	Max	9.3	9.3			
Square	Min	1.9	1.9	2.1	2.1	3.99
	Max	2.5	2.5			

Figure 4.55: Shape and dimensions of built structures recorded from burnt mounds between 1950–2010.

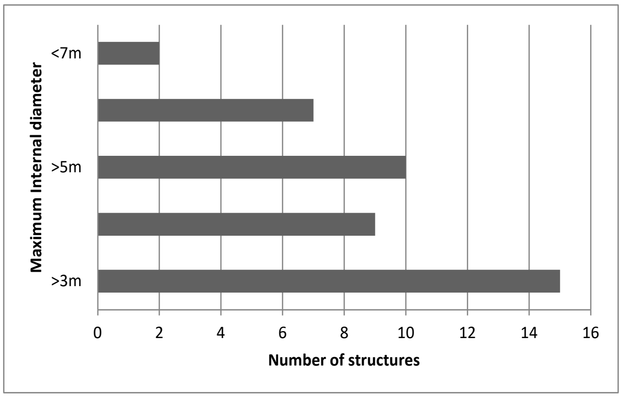

Figure 4.56: Internal dimensions of build structures excavated from burnt mounds in Ireland.

Trough structures (TYPE A)

Stake-holes surrounding troughs are not uncommon and usually represent some form of ancillary structure, such as a suspension frame or light canopy. Examples include those at Castlecook, Co. Cork (CO95), and Ballyglass West, Co. Galway (GY31) (Cleary 2015; Delaney and Tierney 2011). In other cases, the evidence is more substantial, possibly representing larger roofed buildings, such as those found at Scartbarry I (CO54), Coolmoohan (CO94), Carrignafoy in Co. Cork (CO81), and Cloughjordan, Co. Tipperary (TY65) (Hurley and Hanley 2013; O'Meara and Molloy 2010; Ní Loingsigh 2007; Dennehy 2006). These larger structures share a common set of features, including burnt mounds, large elongated troughs, substantial formal hearth-settings and large posts sometimes set within slot-trenches (Figure 4.57; Figure 4.58). Although built of timber rather than stone, their size and design can be compared to the aforementioned Scottish structures with internal troughs.

A good example is Scartbarry, Co. Cork (CO54), where an oval slot trench measuring 5m by 5m surrounded the remains of a 5m long stone-lined trough with a stone-built hearth at the shorter end (O'Neill 2006; Hanley and Hurley 2013). Hazel charcoal from the basal/primary fill of the trough is dated 1650–1190 BC, while oak charcoal from a fill within the slot-trench is dated 1440–1020 BC. Similarly, at Carrignafoy, Co. Cork (CO81), a setting of large post-holes within a slot trench surrounded a large stone and timber-lined trough that also measured 5m in length (Ní Loingsigh 2007). Hazel charcoal from the fill of the slot-trench is dated 1433–1271 BC, while an associated post socket is dated 1509−1399 BC. This site also had an adjacent hearth built of stone. A water-channel at the site connected the trough to a lower pit that served to empty the former. Salix/populous charcoal from one is these features is dated 1291–1053 BC. A possible emptying pit was also identified at Scartbarry (Hanley and Hurley 2013: 108).

The structure at Coolmoohan, Co. Cork (CO94) was constructed with a number of free-standing posts set within substantial slot-trenches. Large post-holes surrounded a

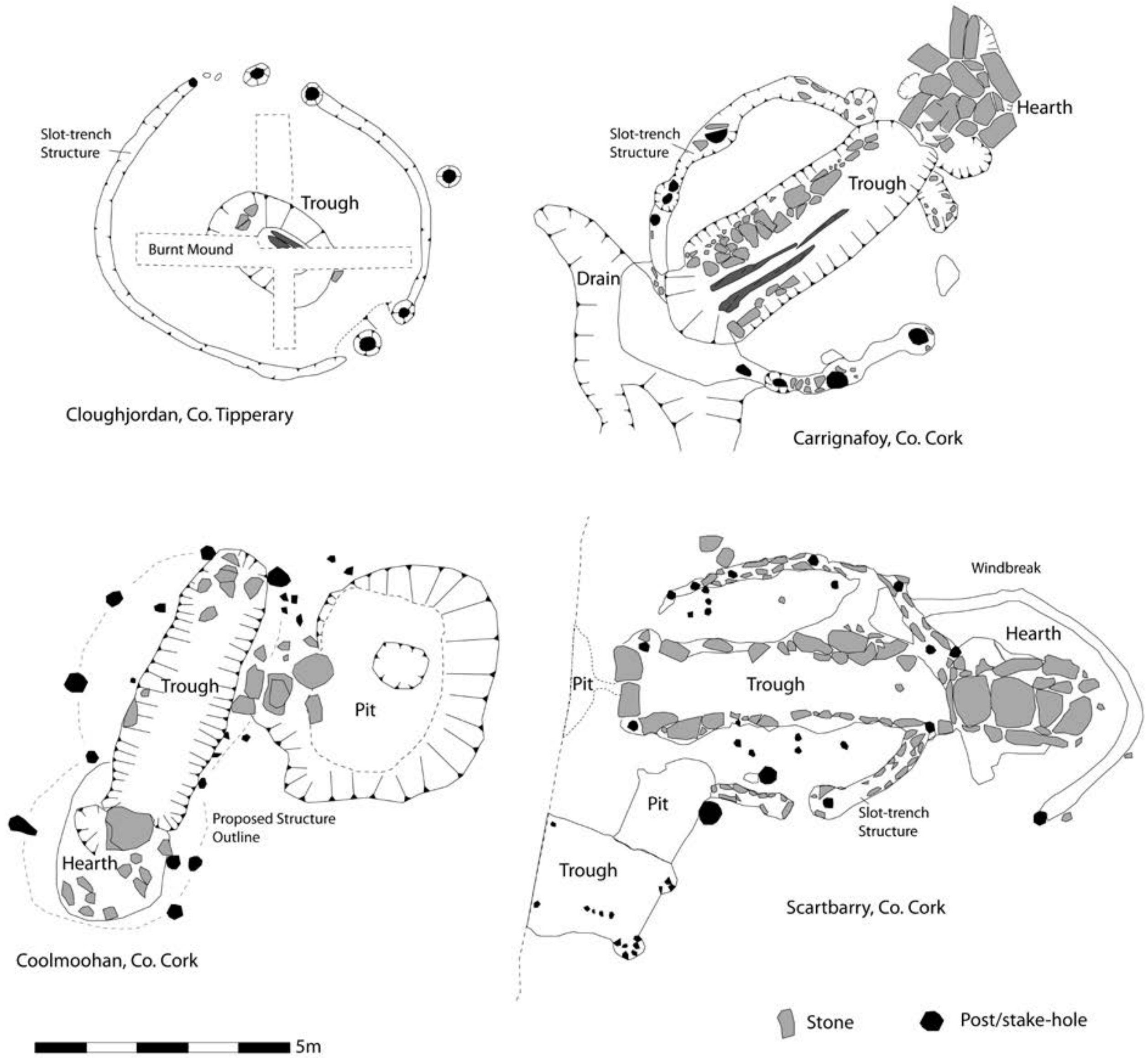

Figure 4.57: Type A burnt mound structures excavated from Ireland.

trough that measured 2.1m by 1.4m, while a large formal hearth was also shielded by a group of post-holes similar to Scartbarry (O'Meara and Molloy 2010; Cleary 2015). Hazel charcoal from one of these post-holes is dated to the Middle/Late Bronze Age, 1382–1134 BC. Immediately east of this structure was a large deep pit with a stepped profile and flat base, which may represent a plunge pool. A sample of ash charcoal from a possible spring is dated 1121–935 BC.

The structure at Cloughjordan, Co. Tipperary, was sub-circular, measuring 6.5m by 5.5m in internal diameter (TY65a; Dennehy 2006). It was comprised of a narrow slot trench that accommodated wooden uprights for the construction of wattle and daub walls. Charcoal from the fill of this trench is dated 1190–920 BC. It had two entrances, one in the south-east and one in the south-west, which were each defined by two large post-holes. Charcoal from one of these is dated 1210–940 BC. No internal roof or wall supports were present, suggesting that the structure was not intended for prolonged use. It was either unroofed or constructed with light materials such as hides or woven mats (*ibid*.: 15). The internal timber-lined trough was not centrally located within the hut, but instead positioned close to the south-western entrance. The excavators of these sites have variously interpreted the structural remains as representing prehistoric saunas or sweat lodges that used steam generated from the water troughs. Unfortunately, there are no artefact finds to shed light on the use of these sites. Additional external troughs or pits were also present, but the stratigraphic relationship of these features is not always clear, and they may relate to separate phases of activity.

Figure 4.58: Large trough, hearth and structure (Type A) at Scartbarry, Co. Cork (left) and Possible 'sweat lodge' (Type B) at Rathpatrick, Co. Kilkenny. Source: Ken Hanley (TII) and Trish Long (Rubicon Heritage Services Ltd).

Sunken pit structures (TYPE B)

This form of structure is usually associated with large circular pits within an internal arrangement of post or stake-holes, suggesting a roofed hut or tented structure (Figure 4.59). These can have internal pit features, while some have evidence of external troughs, as at Rathpatrick, Co. Kilkenny (KK19; Eogan and Shee-Twohig 2011: 180). At Blanchvillespark 3, Co. Kilkenny (KK35), the structure was comprised of 18 post-holes set within a shallow rectangular pit measuring 6.5m by 3m by 0.1m in depth (KK35; Coughlan and Bailey 2011). Hazel charcoal from one post is dated 1400–1268 BC, while spindle charcoal from another is dated 1412–1269 BC. It is not clear if the pit was man-made or natural, but it does seem likely the structure was deliberately placed in relation to an adjacent pond and stream. During the prehistoric period, this area was probably marshy ground prone to flooding. The structure was connected to the pond by a palaeochannel that extended from the north-west, which helped to direct water away from the work area. The entrance was in the east wall, with a small annex to the main structure located north of that feature. A hearth was identified 2m to the east of the structure. Internally there were two pit features, one of which is likely to have functioned as a receptacle for hot stones (*ibid*.).

At Rathpatrick, Co. Kilkenny (KK19), a large circular pit measuring 5m by 5m by 0.4m was found with an internal ring of stake-holes containing hazel charcoal (Gleeson and Breen 2006; Eogan 2007; Eogan and Shee-Twohig 2011). This suggests a light tented structure, connected to a large rectangular trough by a series of earth-cut steps. A smaller sub-circular pit with a drainage channel was also part of the arrangement. This structure was interpreted as a possible sweat lodge employing a pyrolithic technology to create steam and heat in an enclosed environment, while the adjacent trough was interpreted as a plunge pool. Hazel charcoal from the fill of one of the internal stakes is dated 775–417 BC, while oak charcoal from the fill of the adjacent trough or plunge pool is dated 1014–844 BC. A number of other pits/troughs and possible working surfaces were also identified outside the structure, some of which relate to an Iron Age phase of activity.

A comparable structure associated with burnt mound material was identified at Ballykeoghan, Co. Kilkenny (KK49B; Laidlaw 2008; 2010). The feature was circular in plan and measured 4.70m by 4.30m by 0.60m, with slightly concave sides, flat base, and was adjacent to a palaeochannel and two troughs. Six stake-holes had been cut into the base of the feature, identifiable only because of the presence of wood within the natural sub-soil (Laidlaw

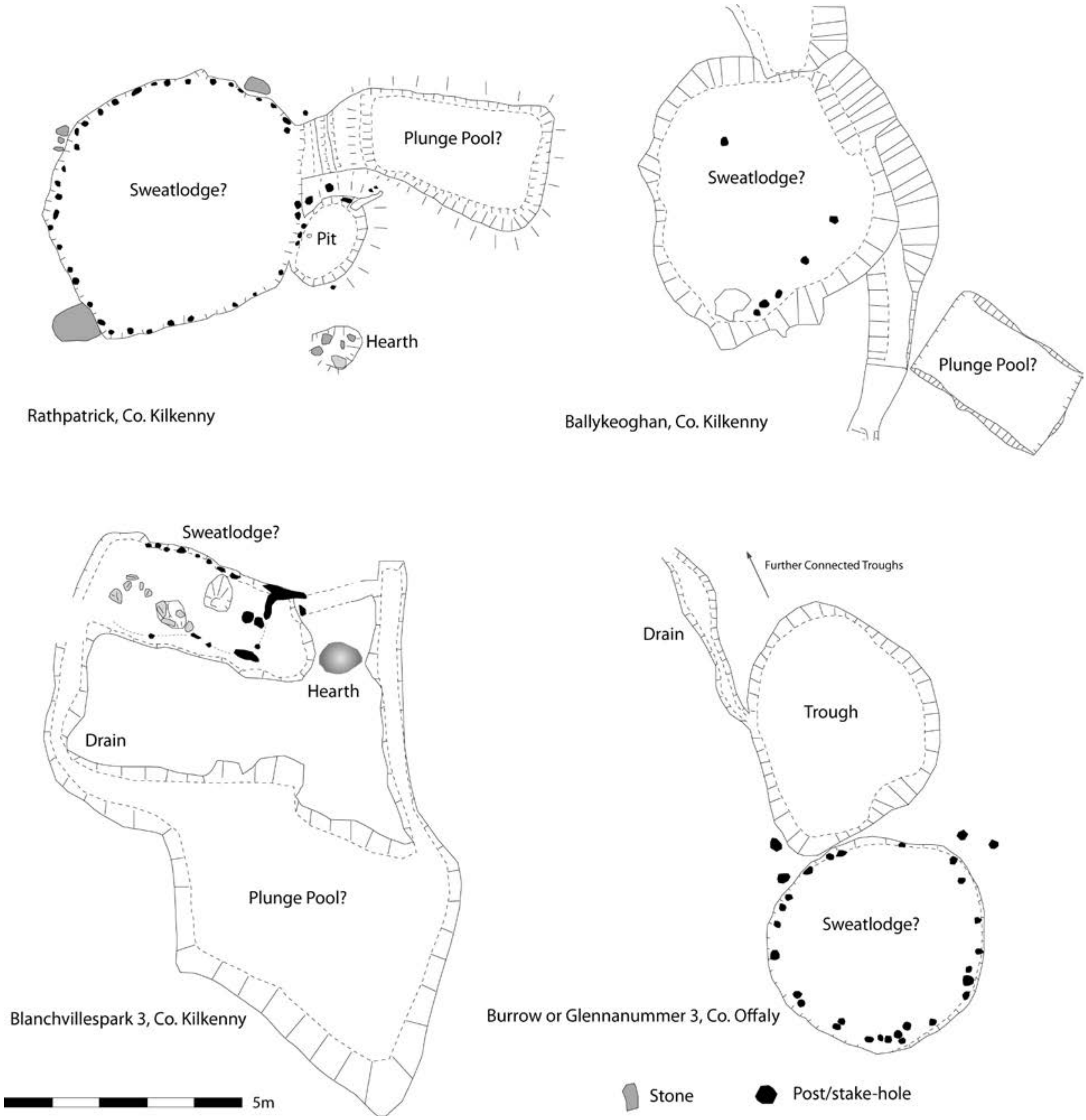

Figure 4.59: Type B burnt mound structures excavated in Ireland.

2010). A radiocarbon date of 1112–974 BC was obtained from a central oak stake, while alder charcoal from the fill of the pit is dated 1053–838 BC. A quern stone and a circular stone disc were recovered from this feature. A similar structure was revealed at Burrow or Glennanummer, Co. Offaly (OY08; Coughlan 2009). The pit measured 3.5m by 3.5m by 0.3 with an internal ring of 25 stake-holes, again suggesting a light framed structure similar to examples noted above. Alder charcoal from one of these stake-holes is dated 1200–930 BC. The identification of this structure as a possible sweat lodge is questionable as it was located at the lowest point of the site, at the end of a shallow slope connected to two troughs to the north. This would have ultimately directed water into the structure from above.

Light tented structures (TYPE C)

This is the most common type of built structure identified at burnt mound sites. Very few of these buildings are in any way substantial, and so most are likely to be temporary shelters for those working at the site (Figure 4.60). Interpreting this structural evidence is often difficult, particularly on multi-phase sites where features are obscured by earlier or later activity. The situation is further complicated by the absence of any material culture and internal features. That said, a number of structures contain small circular or oval pits that could be interpreted as receptacles for hot stones. Given their relative size and the presence of internal pits, these small post-built

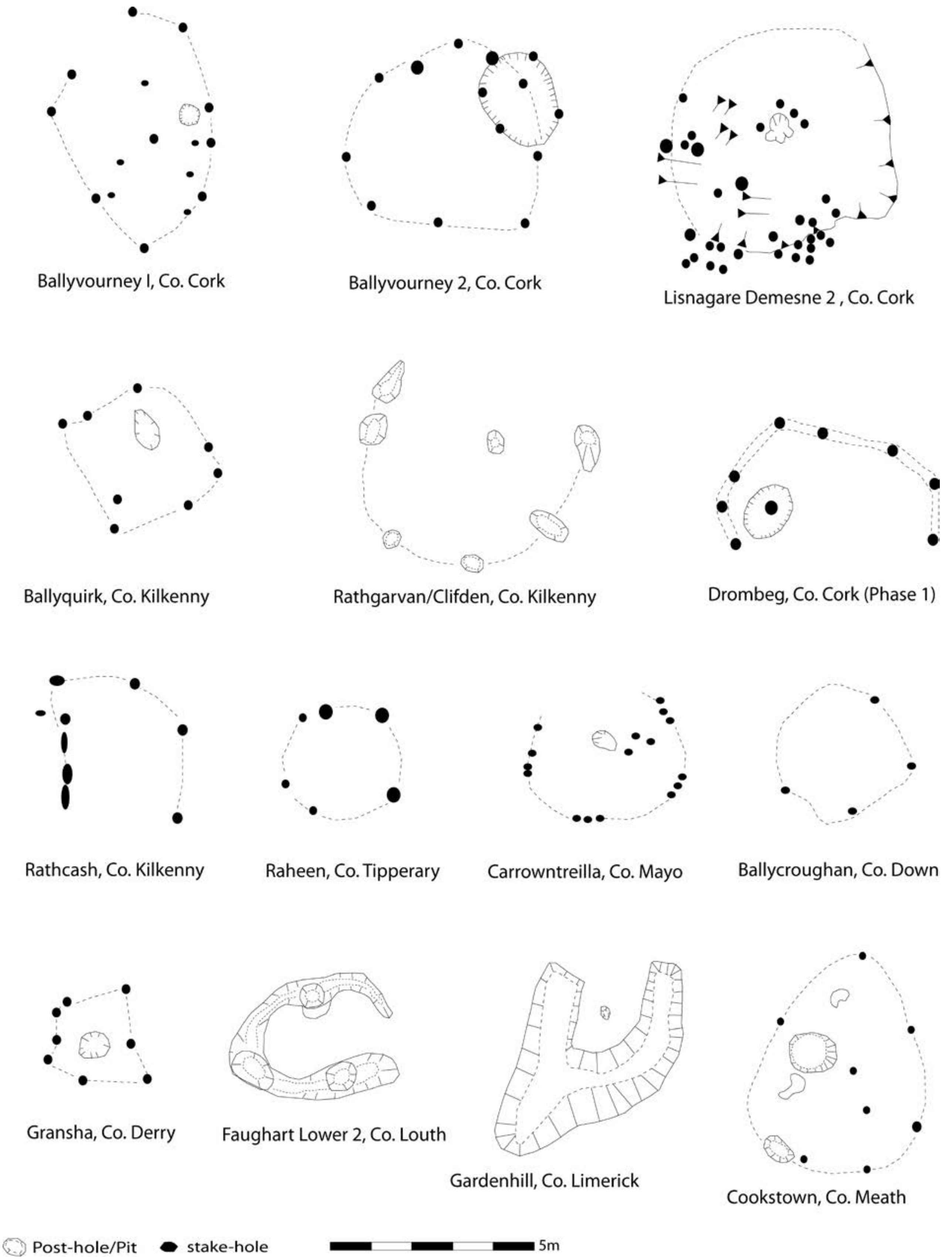

Figure 4.60: Type C stake-and post-built structures excavated from burnt mounds in Ireland.

structures may have functioned as sweatlodges, where water was poured on hot stones within the pits to create steam in an enclosed space. Thirteen of these examples have been uncovered including Ballysquirk, Co. Kilkenny (KK33c), Cookstown, Co. Meath (MH86), Carrowntreilla, Co. Mayo (MO40), Clonmore North, Co. Tipperary (TY34), Ballyvourney, Co. Cork (CO02) and Gransha, Co. Derry (DY03). The vast majority of structures (some 42 examples) do not have any evidence for internal pits, but this does not preclude the possibility that they may have served a similar function. Very few of these buildings are in any way substantial, but most are likely to be related to the activity at the mound sites, as temporary shelters for those working at the site. Examples include those at Baysrath, Co. Kilkenny (KK34a); Ballycroghan, Co. Down (DW01); Gortibrigane, Co. Tipperary; Rathcash, Co. Kilkenny (KK40); Ratheen, Co. Tipperary (TY28); Gardenhill, Co. Limerick (LK67) and Ballyvourney II, Co. Cork (CO03).

4.12 OTHER STAKE AND POST-BUILT STRUCTURES

Other types of stake-built structures are commonly found at burnt mound sites. These are different from the structures mentioned previously as they do not represent roofed buildings. They range from tight clusters of stake-holes found close to troughs, to examples that appear to form alignments such as fence-lines or windbreaks. Occasionally, pairs or small groups of stake and post-holes are interpreted as racks or spits, used for the drying or skinning of animal hides and possibly the roasting of meat (Ó Drisceoil 1980; Waddell 2000).

While consistently noted during excavation, these features are given little attention by excavators. Part of the reason is the equivocal nature of the physical evidence. Similar ephemeral structures are commonly found at Bronze Age settlement sites, usually associated with hearths and external pits and are interpreted in the same manner (Cleary 2007: 100). Stake-hole features are reported from some 200 excavated burnt mounds. It is possible that many other sites possessed similar arrangements but were undetectable due to limited excavation, truncation or repeated re-occupations, resulting in an obscured record. They occur in a number of different forms such as:

- Fence-lines/enclosing elements
- Hearth furniture (windbreaks, spits, racks etc.)
- Stake-arcs associated with troughs
- Nucleated stake-clusters found adjacent to troughs

Fence-lines and possible windbreaks

Sometimes stake-holes form linear arrangements indicative of palisade fence-lines. Some of these are too small to offer any meaningful interpretation, although some have suggested they may have formed racks for the drying and preparing of animal hides. For instance, at Graigueshoneen, Co. Waterford (WD04), a series of five closely-spaced stake-holes were identified 5m north-west of the troughs. A similar set of stake-holes were identified at Stoneyhouse Farm, Co. Westmeath (WM61a) (McDermott 2009) and Lissava, Co. Tipperary (TY32), both set within slot trenches. At Cahiracon, Co. Clare (CE21), three stake-holes were interpreted as forming a drying rack close to a number of troughs, while at Cregganmacar, Co. Westmeath (WM29) four sizable post-holes appeared to be randomly placed away from the trough. Dispersed arrangements of post and stake-holes are also common and do not form any definitive plans. For instance, at Killoran, Co. Tipperary (TY04), 28 dispersed in situ stakes were identified, while 41 stake-holes were found in a dispersed manner at Courteencurragh, Co. Wexford (WX14). In total, 33 sites display such groupings, including examples at Coolfore, Co. Louth (LH11), Knockadrina, Co. Kilkenny (KK38) and Roestown, Co. Meath (MH50).

Some larger arrangements are substantial enough to suggest they may have formed enclosing elements. At Ballyquirk 4, Co. Kilkenny (KK33c), five post-holes formed a U-shaped enclosure or boundary fence, demarcating the burnt spread and the working area of the site (Jennings *et al.* 2011). A similar enclosing fence-line uncovered at Moanduff 1, Co. Carlow (CW14), was initially thought to be contemporary with the burnt mound, but was later shown to be an unrelated feature dating to the Late Iron Age (Lynch 2012). At Ballynamony, Co. Kildare (KD31), a double row of stake lines situated c.4m from the trough were orientated in a north-west/south-east direction for a distance of 7m. Both lines joined a single stake-hole, and the excavator suggests that the formation likely represented a series of windbreaks used to protect the site from prevailing winds (Clark 2010b).

One of the most substantial windbreak structures uncovered during excavation was at Strandfield, Co. Wexford (WX03) (McCarthy 2002). This consisted of a curvilinear trench that extended from the south-eastern end of the excavated area for a distance of 4.48m before curving towards the north-west for a length of 2m. The trench was cut by a number of large post-holes that displayed evidence to suggest it was burnt down. As the site is situated close toWexford Harbour, the structure was interpreted as a substantial fence to protect the working area of the site from coastal winds (*ibid.*). Similar linear arrangements were encountered at Kilmurry North, Co. Wicklow (WW47); Newtown, Co. Louth (LH19); Ballinaspig More 6, Co. Cork (CO42); Richill Co. Limerick (LK65a); Knock, Co. Dublin (DN11); Aghafin, Co. Westmeath (WM27) and Raheenagureen, Co. Wexford (WX21c).

Trough stake-hole clusters

This section deals with a number of features often found in the immediate vicinity of burnt mound troughs (Figure 4.61). Some of these represent a palimpsest of different use phases where structures, whatever their function, where

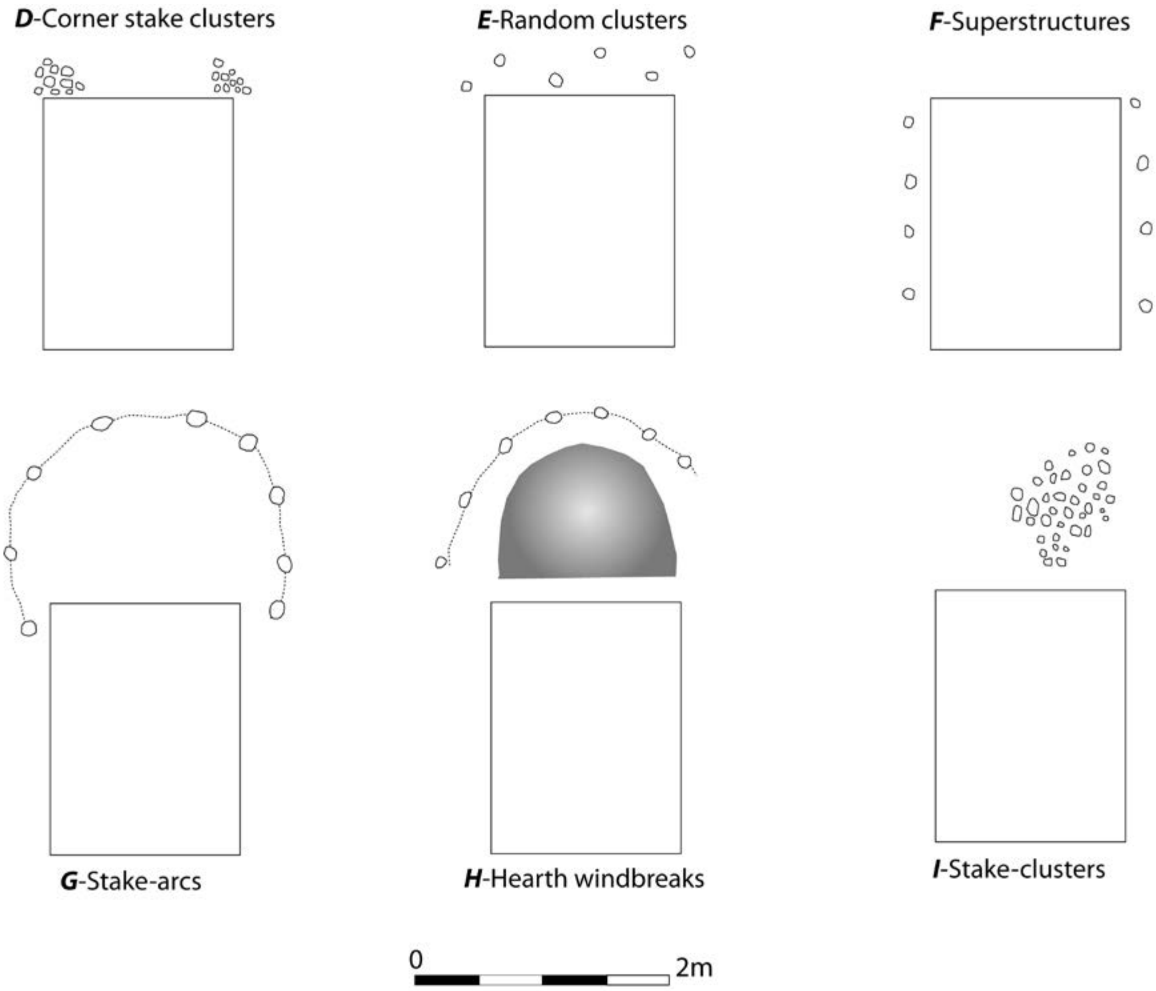

Figure 4.61: Range of other stake-hole structures associated with troughs in Ireland.

constantly replaced due to the wet and unstable ground conditions. One striking feature is their concentration of these stake-hole features at the shorter ends of rectangular troughs and their general absence in other areas. This pattern, together with the complementary location of hearths and burnt mounds, strongly suggests a connection with the use of these sites. The similarity in layout of these arrangements in different parts of the country suggests that some specific structure was common at troughs of this type. Furthermore, the presence of working surfaces predominantly located at the long sides of troughs suggests the pits were generally accessed and worked from these areas. This accounts for the absence of stake-built structures in these locations.

Type 'D' structures

These structures represent closely spaced stake-holes/post-holes cut into the upper edges or outside corners of rectangular troughs (Figure 4.62). Seventeen sites display such evidence including Woodstown 10, Co. Waterford (WD13), where two groups of multiple and closely spaced post-holes and stake-holes were cut into the southern end of the sub-rectangular trough at its south-east and south-west corners. Similar arrangements of post and stake-holes have been identified at Fauleens, Co. Mayo (MO59); Ask, Co. Wexford (WX05); Scartbarry Co. Cork (CO63); Ballyclough, Co. Cork (C011-12), and Caltragh 9, Co. Sligo (SO16). The fact that many are intercut suggests that these structures were replaced on a regular basis.

The most widely held view is that these arrangements functioned as additional corner supports as many of these troughs were timber-lined. While this may be the case at several sites, it seems unlikely in others as they only occur at one end of the trough and not at the opposing ends as might be expected. As mentioned previously, it may have been necessary to have some retaining structure in place on the edge of the trough while the hearth firing was in progress, so as to keep the fire back from the trench. This was probably the function of the two stones set on edge at the northwest and southwest corners of the trough at Meenane, Co. Cork (CO16) and a linear line of stones at the edge of a trough at Castlecook, Co. Cork (CO95). At Drombeg, Co. Cork (CO07), the base of the hearth was 0.1m deep so that the end stone of the trough formed a

Figure 4.62: Stake-hole cluster in corners of trough pit at Scartbarry Co. Cork (Type D). Source: Eachtra Archaeological Projects Ltd and Transport Infrastructure Ireland.

barrier against the ashes, which would otherwise have been knocked into the water while it was being filled with hot stones. At Fauleens 1, Co. Mayo (MO60) the south-east end timber projected 0.28m above the level of the side timbers suggesting it may have functioned in a similar manner. Therefore, it is possible that these stake-holes may have functioned as supports for a timber barrier to maintain the fire and prevent unwanted debris from entering the water. While it is possible these stakes could have been used to support a timber or brushwood working surface in place, this seems unlikely if we consider the general location of these features. For example, at Ballyclough, Co. Wicklow (WW44b), a possible working surface was located at the long side of the trough, while a short line of stake-holes at one of the shorter ends may have been a possible retaining barrier. This indicates that the trough was accessed and worked only from the longer sides.

Type 'E' structures

Type E structures include arrangements of stake- and post-holes that occur immediately adjacent to troughs. These are so few in number and often randomly placed that interpretation is difficult. Twenty-five sites display such evidence, usually ranging from one stake- or post-hole to approximately five. Examples include Moyveela, Co. Galway (GY23); Cappaloughlin, Co. Laois (LS22a); Ballynagard, Co. Clare (CE16); Dalystown, Co. Westmeath (WM03) and Woodlands East, Co. Kildare (KD36). Some have suggested that these stakes-holes represent small tripod frames for suspending something over the trough, or else pegs to secure a leather lining in place. The later seems unlikely as no finds of leather are recorded in these sites. These staves may have acted as further trough or platform supports or even barriers similar to Type A structures.

Type 'F' structures

These structures are represented by stake-holes or lines of stake-holes along the longer ends of troughs. They differ from the 'Trough Structures' outlined above in that they cannot be interpreted as buildings due to the ephemeral nature of the evidence. They may have functioned as light canopies, constructed over pits for protection against adverse weather conditions or as possible supports for some spit structure suspended over the trough. Fifteen sites display such evidence represented by a linear series of stake or post-holes running lengthways on either side of a rectilinear trough or located around the perimeter of circular examples. While some sites may indicate evidence of roofed troughs, they should not be confused with those examples at Scartbarry Co. Cork (CO54); Carrignafoy, Co. Cork (CO81); Coolmoohan, Co. Cork (CO94) and Cloughjordan, Co. Tipperary (TY65).

For example, at Gortnaboul, Co. Clare (NC) a possible tent-like structure was initially identified, but it is now evident that these stakes relate to internal trough supports (Hanley 1999). A similar situation was identified at Ballymaley Co. Clare (CE02) and Castletown Co. Kilkenny (KK10), both of which can now be confirmed as relating to trough supports. At Tonafortes 2, Co. Sligo (SO19a), a series of stake-holes around the southern and south-western edges of a trough were interpreted as the remains of a roofed structure (Danaher and Cagney 2005). It is improbable that this trough was roofed and used as a sauna given the scant nature of the evidence. The same can be said for a trough at Maheraboy 1, Co. Sligo (SO17), as that pit was only 1m in diameter, leaving little or no space for a person to bath in steam, especially if there was a surrounding canopy (Danaher 2007: 28). These stakes are more comparable to Type B structures and probably were spit features or possible hoists for the insertion or removal of stones or meat from the trough.

At Knock, Co. Dublin (DN11), the excavator interpreted two large post-holes identified at the east and western ends of a trough as representing some form of superstructure covering the pit for use as a possible sauna (Tobin 2002). However, for such a scenario to take place, the pit would have to be fully enclosed like examples uncovered from Rathpatrick, Co. Kilkenny (KK19) and Burrow and Glennaummer Co. Offaly (OY08). As burnt mounds are open-air sites, simple coverings may have been used from time to time to shelter the trough and working area during adverse weather conditions. This may have been the purpose of a series of widely-space post-holes surrounding

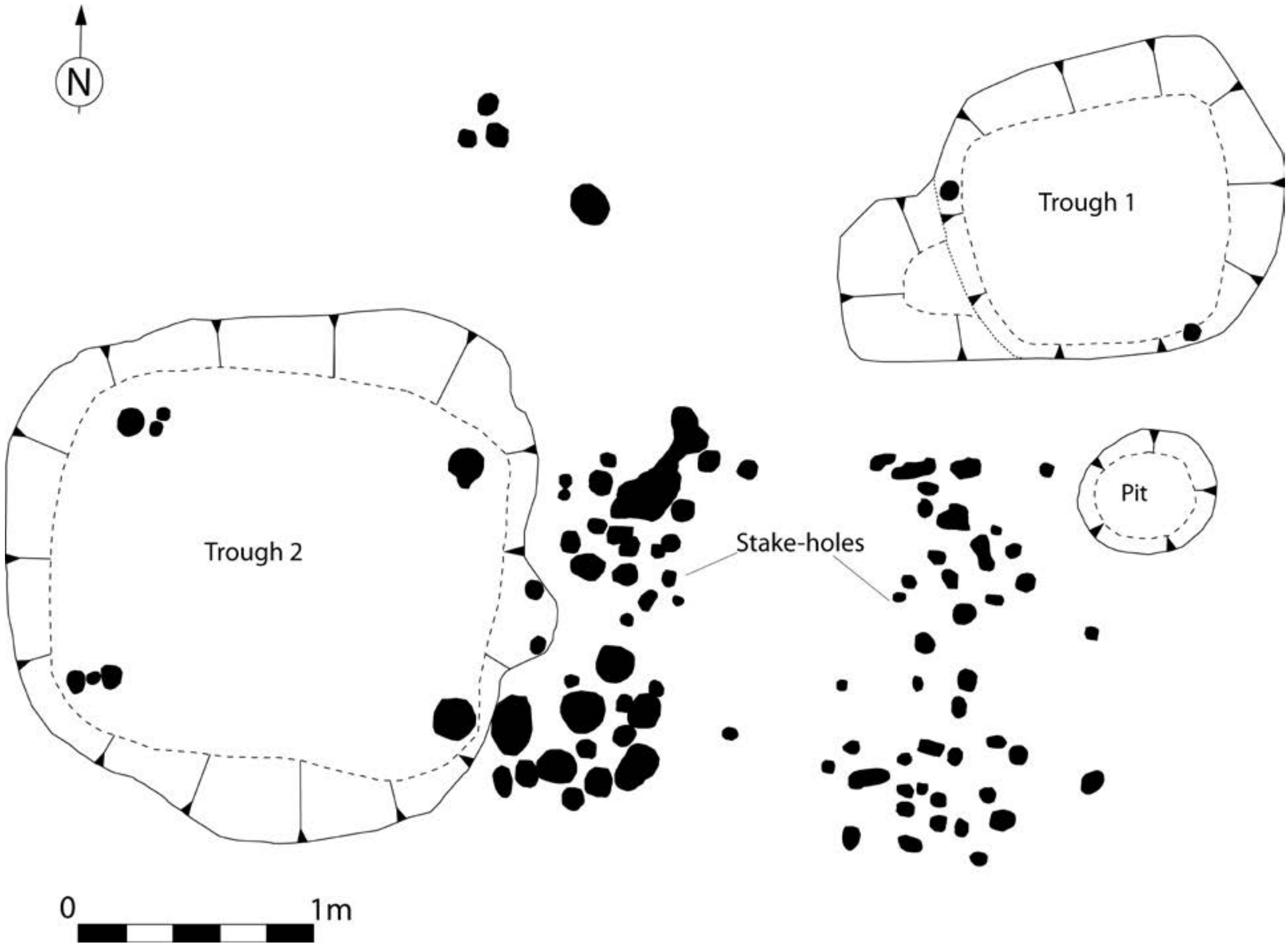

Figure 4.63: Plan of excavated features at Moanmore 1, Co. Carlow. Source: Redrawn from Jennings and Coughlan 2012 (IAC Ltd).

a rectangular trough at Barnahely, Co. Cork and Danesfort 2, Co. Kilkenny (McCarthy 2002; Jennings and Coughlan 2011).

The closely spaced stake-holes identified along the edges of troughs at Ballinaspig More 7, Co. Cork (CO43); Castlecook, Co. Cork (CO98); Lissava, Co. Tipperary (TY30); Mitchelstown, Co. Cork (CO59), and Ballyglass West, Co. Galway (GY31) are similar to the more substantial examples listed above in their position and association with large troughs. The stakes at Ballinaspig More 7 (CO43) were angled inward suggesting the presence of a superstructure associated with the trough during a second phase of activity on the site, which the excavator suggested may have been used as an enclosed bath or sauna (Danaher 2004).

Type 'G' structures

These structures represent U-shaped, circular or sub-circular stake or post-hole arrangements, usually found adjacent to rectangular, oval and circular troughs (Figure 4.63). These structures are generally positioned in a way that they are open to the trough at the shorter ends (especially rectilinear troughs). Thirty-three sites display evidence of such structures including Charlesland, Co. Wicklow (WW22); Kellymount, 2, Co. Kilkenny (KK56); Meenane, Co. Cork (CO16); Clogh East, Co. Limerick (LK38); Raheengureen, Co. Wexford (WX21), and Carrowtreilla, Co. Mayo (MO40).

As hearths are often positioned in these areas, protective screens or windbreaks may have been necessary to shield the fire from prevailing winds. Convincing examples have been uncovered at Scartbarry, Co. Cork (CO54) and Clogh East, Co. Limerick (LK38). As discussed in relation to hearths (see above), the evidence suggests that the protection of the fire was a major concern as the majority are positioned in front of mounds, sometimes built of stone with high retaining walls. The problem, however, is that, for the most part, the archaeological evidence does not support the suggestion that Type D settings protected hearths, as areas of burning are typically rare. This does not discount an association with hearths, given that 130 of the 218 examples identified are located immediately adjacent to the trough at the shorter end where trough structures typically occur. As already noted, it is possible that hearths may have been constructed on raised bases of stone or clay, protecting them from underlying saturated ground conditions. Alternatively, the fire may have been set directly on humic topsoil, thus preventing the underlying subsoil from becoming fire-reddened (Canti and Linford 2000: 393).

It is possible that these structures served a dual purpose, forming a protective screen for the hearth while also serving to retain the mound material similar to the stone equivalents uncovered elsewhere (see above). The semi-circular settings at Meenane Co. Cork (CO16); Ballyloughlan, Co. Wexford (WX09); Kellymount 2, Co. Kilkenny (KK56), and Carrowntreila, Co. Mayo (MO40) may have functioned in this manner. An arrangement of 30 stake-holes encircling a burnt mound at Knockspark, Co. Sligo (SO04), may also have retained the material from entering the working area of the site.

Type 'H' structures

The aforementioned stake-holes were found associated with 33 identified hearths of the formal and informal type. Of the formal hearths, 21 examples are associated with stake-holes, the majority exhibiting clustered formations such as at Ardskeagh Beg, Co. Galway (GY33), Brackbaun, Co. Limerick (LK61) and Curragh, Co. Laois (LS35). These may represent a number of different spit or tripod structures for more direct methods of cooking. Similar arrangements are found associated with hearths at a number of Bronze Age houses (Doody 2007; Cleary 2007). Nine sites had arrangements consistent with possible screens or windbreaks, effectively shielding the hearth from prevailing winds while also protecting it from encroaching mound material. These can be closely related to Type D structures with the only difference being the archaeological visibility of fire-reddened subsoil. Examples include Ballydowney, Co. Kerry (KY10), Clogh East Co. Limerick (LK39), Knockhouse Lower, Co. Waterford (WD20) and Fermoy, Co. Cork (CO64).

Type 'I' structures

These structures represent closely spaced stake and post-hole clusters that are usually identified within 2m of the short end of trough. Thirty-three sites display evidence of such structures, including Ardagawna Co. Roscommon (RM13), Clogh, Co. Wexford (WX11), Kingstown, Co. Dublin (DN03), Ballyburn Lower, Co. Kildare (KD15) and Macroney Upper Co. Cork (CO97). These range from small clusters of six stakeholes to large numbers up to 70, and can often display evidence of being inter-cut. As to the type of structure they represent, most occur too close together to form any obvious construction. Some are interpreted as possibly forming tripod arrangements for the raised butchery of animals or the collection of blood (John Tierney pers. comm.). The clustering formation is explained by wet and unstable ground conditions where structures were replaced and rearranged over time. Certainly, some form of tripod would have been beneficial at these sites as ground level butchery would have been disorderly, contaminating the working area of the site. Interestingly, a perforated animal bone recovered from the fill of a trough at Kilbeg, Co. Westmeath (WM36), suggested that the animal was hung or cured, though it cannot be confirmed whether this was undertaken on site. While some stake-holes are angled inwards giving the impression of such structures, this may be a factor relating to the wet ground conditions. Furthermore, these clusters are represented by small stake-holes and not larger post-holes as one would expect if these features held carcasses. The majority are not tilted inwards towards each other to suggest some sort of tripod. Such clustered arrangements could allow a wide variety of reconstructions, connected to a variety of functions. Without additional evidence no firm conclusions can be reached from the ground plans alone.

4.13 ENCLOSURES

A small number of excavated burnt mounds have tentative evidence of enclosures. Different forms have been identified ranging from large ditched enclosures at Tintore 2, Co. Laois (LS47), Boyerstown 8, Co. Meath (MH49) and Knocks 1, Co. Meath (MH79), to smaller examples at Scartbarry 1, Co. Cork (CO54). Possible fence or palisaded enclosures have also been revealed at Ballyquirk 4, Co. Kilkenny (KK33c), Moanduff, Co. Carlow (CW13), Ballynamona, Co. Kildare (KD31) and Knockspark Co. Sligo (SO04).

Establishing the chronological relationship of these enclosing features and many burnt mounds remains problematic. For instance, at Moanduff, Co. Carlow (CW13), radiocarbon dating of the timber fence confirmed it was unrelated to the earlier pyrolithic activity (Lynch 2012). Similarly, at Boyerstown 8, Co. Meath, the precise relationship between the enclosing ditch and the features within is unknown as only the burnt mound features were dated (Clarke 2008). At Camlin 1, Co. Tipperary (TY69), the enclosing ditch surrounding three burnt mounds was shown to be early medieval in date.

At Tintore 2, Co. Laois (LS47), a univallate enclosure measuring 30m by 33m surrounded a series of pits, spreads and possible troughs. A radiocarbon date of 1000–820 BC was obtained from the ditch, while a date of 810–410 BC came from one of the central trough features. In spite of the discrepancy between dates, the enclosure and pyrolithic activity are considered contemporary based on the central position of the burnt mound and the factors such as the 'old wood effect'. Even if the burnt mound was not entirely contemporary with the establishment of the enclosure, the site may have existed as an abandoned, half silted enclosure that was re-used for pyrolithic activity. This is supported by the presence of food waste and burnt stone from the fill of the enclosing ditch, possibly representing dumped material from use in the troughs (Kenny 2007: 168). Additional radiocarbon dates are required from more secure contexts in order to establish a reliable chronology for the site. Similarly, the ditch at Knocks 1, Co. Meath (MH79), remains enigmatic, and was probably not contemporary with the activity taking place within its confines. Animal bone from the ditch fill is dated to the Late Bronze Age, while one of the internal pits is Early Bronze Age, consistent with the lithic finds from the site. It is, therefore, most likely that the enclosure ditch was substantially later than some of the activity in this site.

Although the archaeological evidence does not support the suggestion that burnt mounds were enclosed, this cannot entirely be ruled out. At some pyrolithic sites, excavation has been able to fully confirm a stratigraphic association between the enclosing element and the burnt mound activity. For instance, at Scartbarry I, Co. Cork (CO54), a shallow boundary/enclosure partially enclosed a site interpreted as a possible sweatlodge. This boundary may originally have enclosed the entire site, however it seems to have been badly truncated at some stage. The elements that do survive seem to contain an entrance feature consisting of a causeway on the southern side. The structure did not have any structural use as it was shallow and did not contain any evidence of associated postholes. The function remains enigmatic, but it does reflect the importance attached to the cooking structure (or possible sweatlodge) inside the enclosure. Similarly, at Ballyquirk 4, Co. Kilkenny (KK33c), a burnt mound showed evidence for a possible enclosing fence/palisade, with five postholes identified around the perimeter of the main area of activity. Three of these formed a perfect straight north–south line immediately to the west of the mound deposit, with the other two postholes at right angles to this line, one at the north the other at the south.

The very act of enclosing an area created an inner space separated from the outside world. If these enclosures encircle and defined areas of pyrolithic activity, this inner space could have been the setting for complex social interaction. However, the act of enclosure was also an act of boundary (Webster 1997), and it is well known that communities in prehistory invested artificial enclosures with profound symbolic and ritual significances (Dowling 2006). Through the act of enclosing spaces at locales such as Ballyquirk, Scartbarry, and possibly at Tintore, Knocks and Boyerstown, people were shaping their own landscape todefine and establish their own place in the world. Evidence of internal cooking practices could indicate that these particular sites with enclosing elements may have been perceived as places of symbolic importance and significance. Indeed, these particular enclosures may have been special areas reserved for high status feasting and cooking practices. This is supported by the particularly impressive site at Scartbarry 1, Co. Cork and although the site is interpreted as a sweatlodge, it may have equally been connected with larger outputs of food for feasting purposes, perhaps on ceremonial occasions. Therefore, the act of enclosure tentatively exhibited at some sites may have served to limit and restrict (human and animal) access to the interior of the site, thus defining some sort of special area.

4.14 SITE CLASSIFICATION

Although there has been an attempt to classify site features such as trough pits and structures (Ó Néill 2009), there has been little effort to categorize burnt mounds as a site type given the variability noted in recent years. As such, substantial issues concerning their chronological and cultural position were unresolved until recent years. As discussed in Chapter 1, Brindley, Lanting and Mook suggested that in Ireland, mounds with accompanying troughs should be referred to as *fulacht fiadh*, whereas sites without such boiling pits should be assigned the term ‘burnt mound’ (1989–1990: 25–33). In light of recent evidence, this may be viewed as rather simplistic as these sites now show considerable variability even though many share the same basic characteristics.

In his discussion relating to Scottish burnt mounds Barber (1990) suggested a fourfold classification for burnt mounds based on the relative proportion of burnt mound material and settlement debris. The common ‘burnt mound’ sites, such as the *fulacht fia* of Ireland, fall into his Class 1. These sites have no direct association with settlements. Class 2 occur in clusters of mounds. Class 3 refers to mounds where structures have been found in direct association, and Class 4 sites where burnt material is found within deposits. Whilst Barber himself admits that such classification at best relates to ‘arbitrarily selected points on a continuum which ranges from sites which are all burnt mound material and no settlement debris to sites which are mainly settlement debris containing relatively small amounts of burnt mound material’ (1990: 98) it does serve to illustrate the wide variety of situations in which burnt stone deposits are found.

It is notable that burnt stone deposits, are rarely found in prehistoric settlements in Ireland, where the use of this pyrolithic technology is clearly separated from permanent residential sites. Heat-affected stone consists of fractured, angular and discoloured stone resulting from the heating and cooling conditions. As such, it is important to recognise that not all deposits of heat-shattered stones may reflect ancient pyrolithic processes and can occur both culturally and naturally. This type of material can be found in contexts with a wide variety of type and period. The identification of such material at stream-side locations is probably indicative of the presence of a burnt mound, but in some cases, as at Keelty, Co. Clare (CE44), Gortahown 4, Co. Cork (CE68) and Kilskeagh 3, Co. Galway, the material seems to have been redeposited (see Chapter 4). Away from obvious water-source locations, occurrences of heat-shattered stone might have quite different meanings. Simple ‘burnt stone equals burnt mound’ assumptions need to be avoided unless supported by additional evidence (Powell *et al.* 2008: 566).

Burnt stone can be differentiated based on maximum fire temperature, duration of maximum fire temperature and overall feature morphology. Cultural fires tend to be more symmetrical, spatially defined and contain a regular pattern of rock sizes and rock types, relative to natural fires. One possibility is that they represent single-episode events such as small fire-spots related to tree and scrub clearance, where stones were burnt as a result. The clearing of scrubland and trees for agricultural purposes was a common practice in early medieval Ireland. The burning of unwanted vegetation alters the soil structure, making subsequent planting easier. It also decreases soil

acidity and enhances soil fertility (Rambo 1980: 311). Fire was also used in order to remove large boulders and rocks during field clearance. This process, known as fire-setting, helped break up the rock into moveable amounts, a practice that was still carried out in Ireland during the early twentieth century. A deposit of heat-shattered stone at Trusk Road, Ballybofey, Co. Donegal, was found around a large stone (Buggie and Tierney 2006: 12). A fire relating to scrub clearance may also be identified at Cloonfane IV, Co. Mayo (O'Carroll 2007: 7). The same is likely for sites such as Ballymackeamore, Co. Limerick (LK34) and other sites dated to the medieval periods (see Chapter 5 and 8). Natural fires can also generate fractured and discoloured rocks that can be misinterpreted as the remains of prehistoric burnt mounds. Jackson (1998: 32) has suggested that the cultural use of pyrolithic technology occurs in intentionally created areas where resources are plentiful while natural fires are unintentionally created, occuring across relativley broad areas. High concentrations of charcoal and ash would also support a cultural origin to pyrolithic deposits while heat-affected rock that lack these deposit may be a result of natural fires.

Under Barber's classification system (see Barber 1990), the burnt mounds of Ireland would fall, at least in part, into two classes, similar to examples found in England, Wales and mainland Scotland. This broad classification does little to explain the observed differences now noted. For instance, there is a clear distinction between the heating of water and creation of steam as a one-off episode, leaving perhaps solitary pits with no related spread of burnt stone, and the formalisation of such a site as a monument that is intentionally defined, used, revisited, and sometimes redefined over a period of time (Ripper and Beamish 2012: 198). On the basis of this it appears that some sites were not complex and may have been used for one purpose, while multiple phases of activity represented at many other sites, combined with complex structures, suggest a higher labour input and permanence. Coupled with volumetric observations, it is possible that this group of monuments may represent differing functions or reflect different social meanings. As Anthony (2003: 67) suggests, function need not necessarily be seen in terms of the primary purpose of the site. It may also be viewed in social terms. For instance, two sites may have the same primary purpose but occupy very different positions within the community. This can be seen when comparing Types 1−5 with Type 6 (see below for new classification system). While possibly functioning as cooking locations, the latter may reflect specialised cooking shelters for ceremonial feasting (see Chapter 6). Type 7 sites, however, are clearly distinctive suggesting that the main activity did not involve water-boiling. Instead, it appears that hot stones were used in sweat-bathing. It seems that much of the other variation noted in burnt stone deposits relates to the degree of permanency at a particular site (Types 1−5) or may have some connection with water management/drainage, and not necessarily a different function.

The most identifiable materials associated with pyrolithic technology are deposits of thermally altered stone and one or more pits associated with dry heat or water-boiling. In light of recent excavations, two main variants can be identified; burnt spreads/mounds that have troughs and those that do not. The former can be subdivided into sites with single troughs, multiple troughs, connected troughs, troughs with structures or sites with single pits, no pits or multiple pits. This allows distinctions to be drawn between the different types of site employing pyrolithic technology. It may be that the complexity of burnt mound use cannot be adequately reflected or accommodated within basic site classifications. The available evidence also makes classification difficult due to the disturbed nature of the archaeological record and limitations with respect to excavation extent. Notwithstanding this, there would appear to be a reasonably strong case to argue that some burnt mounds had different uses to others, and that this is not a clearly defined monument type but one with considerable variability in terms of practices and features.

The question remains whether it is possible to detect regional varieties of different pyrolithic sites from the large excavation record in Ireland. Analysis of the various degrees of information available for such sites has shown a number of potential areas of regional variation. For instance, Type 6 sites with large troughs covered by roofed structures have only been found in the south of the country, particularly in Co. Cork (Figure 4.64). They all conform to a basic set of characteristics with each defined by a large trough, stone-built hearth, post-built structure and a number of ancilliary features. These sites were clearly specialised water-boiling areas that fulfilled specific roles. They may have functioned as communal feasting centres and could indicate a regional variant of the burnt mound, where solidly built superstructures were erected over substantial troughs. The multiple phases of activity represented at these sites, combined with complex structures, suggest a higher labour input and permanence. Whether the absence of Type 6 (trough and built structures) in the rest of the Ireland is indicative of cultural outlook or environmental factors, or is simply a gap in the archaeological record, is unclear.

Features interpreted as sweathouses or bathing have also been identified at a number of burnt mounds. In this study they have been identified as Type 7 sites, defined by a large sunken pit internally surrounded by stake-holes. These examples have mainly been identified in the south-east of the country, with three examples found in Co. Kilkenny alone, namely Rathpatrick (KK19), Ballykeoghan (KK49) and Blanchvillespark 3 (KK51). The Ballykeoghan and Rathpatrick sites appear to be very similar to one another and could both have functioned as sweatlodges. They are also both located less than 8km from one another, and have similar radiocarbon dates. Dates from the hazel rods at Rathpatrick indicate an 8th–7th century BC date, while dates show that Ballykeoghan was used from 1053−802 BC. Type 6 and Type 7 pyrolithic sites are the only examples in the study that show any regional

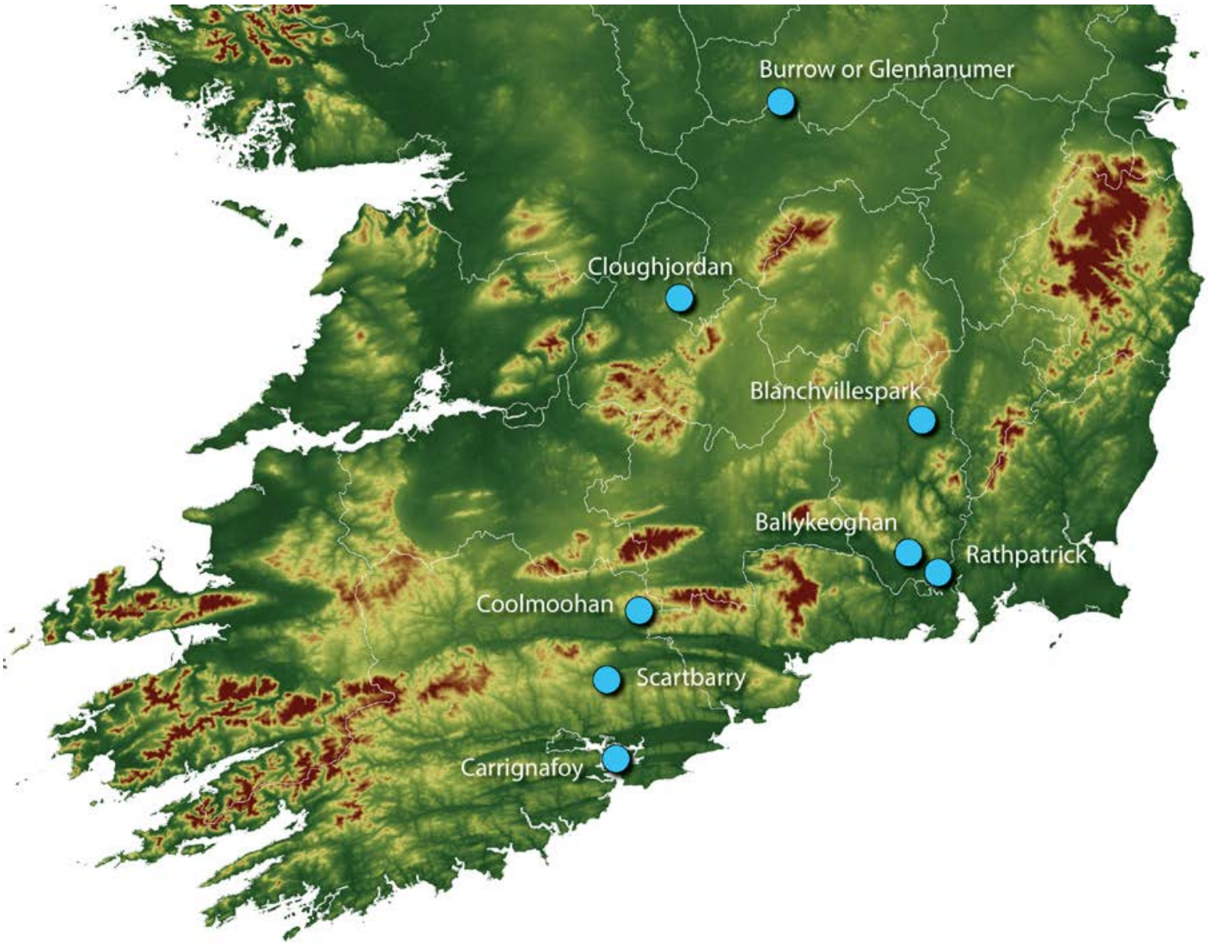

Figure 4.64: Distribution of Types 6 and 7 burnt mound sites in Ireland (Type A structures).

preferences. It is tempting to consider that the same group was responsible for these structures, especially as some were located a relatively short distance away.

Type 1 Mounds with single troughs

The general sequence of events observable at these sites is the digging of a pit or pits which functioned as troughs, followed by the build-up of heat shattered stones and the residues of fires. The one feature all ***larger*** extant mounds have in common, apart from their proximity to one another, is that only one trough is generally present. On this basis it appears that some sites were not complex and may have been used for one specific purpose or a defined period of time. This one trough per mound scenario appears to be the case in areas where tight clusters of sites have been excavated such as at Rathmore, Co. Wicklow (WW07), Killeens, Co. Cork (CO04), Errew, Co. Leitrim (LM12a-c), Ballyclogh Co. Cork (CO11 and CO12), and Caheraphuca Co. Clare (CE47). It is also evident at Cahiracalla Beg, Co. Clare (CE38) and Caherweelder Co. Galway (GY27) where substantial mounds are associated with a single trough located centrally between the arms of the mound. While limited excavation may account for this phenomenon at some earlier excavated sites, large-scale excavation at others suggests this may have been a true occurrence.

Type 2 Complex burnt mounds

Other pyrolithic sites are much more complex and exhibit evidence of prolonged use with the identification of numerous troughs and pits. While it is probable that all the troughs and ancillary features were not in use at the same time, and instead developed sporadically over the life of the site, the evidence suggests significant episodes ofuse. Radiocarbon dating can help to establish the use history of these sites with a number showing considerable periods of inactivity between phases of use. Examples would include sites at Prumplestown, Co. Kildare (KD17); Ballyadam, Co. Cork (CO75); Graigueshoneen, Co. Waterford (WD07); Seeoge, Co. Westmeath (WM21); Ballyglass West Co. Galway (GY31); Carrowntreila, Co. Mayo (MO40) and Johnstown, Co. Carlow (CW03a).

Many of these sites are represented by several well-defined troughs and a large number of associated pits. As mentioned previously, 327 excavated sites have produced evidence for two or more troughs. Extensive deposits of waste-firing material are also present in the form of one

homogenous spread. Occasionally, a number of seperate spread/mound deposits are identified either representing a separate phase or site or damage from later ploughing activity, spreading a number of deposits around the site. Other sites may be the levelled remains of a number of separate burnt mounds visible as single site due to later agricultural damage. In the absence of distinct dump deposits in the stratification of the burnt mound and comprehensive sampling strategy for radiocarbon dating, it is difficult to distinguish what features belong to each phase of use. That said, at some sites, distinct periods of activity can be identified and assigned to a particular phase. This was the case at Cuffsborough, Co. Laois (LS33); Cahiracon, Co. Clare (CE21); Leahy's, Co. Limerick (LK52), and Ballyduff East, Co. Waterford (WD20).

Working on the presumption that the well-defined pits were used for water-boiling, the smaller pits may have been associated with shorter periods of activity that may have developed sporadically over the life-cycle of a particular site. Alternatively, some may have been used in combination with the water-boiling pits for smaller, less time-consuming cooking activities. While the evidence suggests that these sites were returned to, similar to Type 1 examples, in many cases, new troughs were cut and older pits were avoided.

Type 3–4 Short-term pyrolithic sites

Type 3 sites are represented by ***small*** deposits of burnt stone and an associated pit/trough used for either pyrolithic water-boiling or dry roasting. These sites may have been used on a number of brief occasions within a relatively short period of time for episodic cooking. Examples would include sites at Clareabbey, Co. Clare (CE26); Ballincurra, Co. Limerick (LK29); Castlemungret, Co. Limerick (LK38); Bawnfune, Co. Waterford (WD15); Russagh, Co. Offaly (OY09) and Ballinillaun, Co. Galway (GY21). Type 4 sites, on the other hand, are composed of a single pit or trough filled with fired debris. These features are distinctive in that they have no evidence of an associated mound or spread deposit. However, the fill of such features could be a result of post-depositional factors whereby the spread was backfilled into the pit. That said, they probably represent single water-boiling or roasting events employing pyrolithic technology for cooking. Examples include Tinnock Lower, Co. Wexford (WX22); Moneycross Upper, Co. Wexford (WX17); Ardbraccan 3, Co. Meath (MH65); Cornaher, Co. Westmeath (WM52); Commons, Co. Limerick (LK40); Coolfin 4, Co. Laois (LS29) and Caheraphuca, Co. Clare (CE52). Taking into account the possibility of truncation and spreading of mound material, along with sites not being fully exposed by examination, it is clear from a number of infrastructure projects that a percentage of burnt stone deposits never accumulated to the extent they should be referred to as 'mounds'. Many sites employing this technology were short-lived, represented by a pit or a trough deliberately backfilled after a single episode of use. Other pits appear to have been used on a number of occasions by the presence of small adjacent deposits of burnt stone. These sites, however, were used within a relatively short period of time before abandoned.

Short-term pyrolithic sites have not been widely discussed as separate distinct entities in Britain or Ireland with many simply being categorised under the heading 'burnt mound' or 'pot-boiler'. These site-types do not represent the same level of communal social investment as other burnt mounds but are still located in areas of persistent burnt mound activity where larger, more sustained, pyrolithic water-boiling and related processes took place. It is possible, however, that these lesser sites, employing the same technology, could simply be related to different levels of intensity and, unlike larger burnt mounds, were not revisited for further use.

Type 5 Burnt mounds without pits/troughs

Deposits of heat-shattered stone lacking any in situ evidence for a boiling or roasting apparatus mostly reflect partial site investigations in rescue archaeology, particularly excavations connected with road and pipeline networks. Ó Néill's (2009: 190) study suggested that 32% of Irish burnt mounds had no physical evidence of an apparatus; however, in the absence of many final reports, it is unclear whether this is accurate. It is apparent that some of these sites were not excavated or only partially investigated, suggesting that potential troughs or pits may have survived outside the areas exposed. The current study has identified many sites without the presence of a trough or pit, but in most cases the absence of an apparatus is likely due to the limits of excavation where potential pits may lie outside the constraints imposed by developers. Examples include sites at Griffinstown, Co. Westmeath (WM07); Caheraphuca, Co. Clare (CE53); Ballylean, Co. Clare (CE14); Ballingarrane, Co. Limerick (LK31), and Shanakill, Co. Waterford (WD26a-b). It some cases however where the mound has been fully removed and lies within the confines of the excavation corridor, there has been no physical evidence of any form of pit. This was the case at Newtown, Co. Westmeath (WM19); Kilbeg, Co. Westmeath (WM37); Doughiska, Co Galway (GY01); Cooltymurraghy, Co. Galway (GY12); Ballyglass, Co. Mayo (MO41); Caheraphuca, Co. Clare (CE48) and Ballyvollane, Co. Limerick (LK25).

In the absence of cut features such as troughs and pits, others have suggested that portable boiling troughs may have been used, consisting of wood, bronze or leather (Ó Néill 2005; Danaher 2007, 16). At Burrow or Glennaummer, Co. Offaly (OY07), the collapsed remains of a timber trough was uncovered lying on the natural subsoil. A timber trough base was uncovered at Kilbeg, Co. Westmeath (WM36) without being set into any cut feature (Coughlan 2009; Walsh 2009a). While it is unlikely that these examples represented above ground boiling receptacles due to their inability to hold water, the use of dug-out canoes and hollowed out trees in some sites suggests, at least the possibility of portable water-boiling

troughs. For instance, excavation at Ballinvinny, Co. Cork (CO22), suggested the presence of a wooden trough sitting on the ground surface. A date of 1535BC for the the dug-out canoe at Killalough (CO21), excavated directly across the stream from Ballinvinny fits neatly within the date rage of that site (1681−1460 BC). It may well be that the trough was removed from the Ballinvinny site when it was abandoned, and reused on the Killalough site (Cotter 2006). The discovery of other wooden vessels, such as the Pallasboy trough, found along with rope withies in Toar Bog, Co. Westmeath (McDermott *et al.* 2009) hints at the use of mobile cooking vessels (*ibid*.: 54).

Certain historic accounts describe using heated stones to cook in a water-filled bag (French 1899: 43), but experimental work using this technique recorded mixed results (Ryder 1966; 1969), even though the boiling method is also recorded in ethnographical sources (Laubin and Laubin 1989). Such activities would leave small, discrete deposits of heat-shattered stone, with no evidence of the container used to hold the liquid being heated. Other small deposits of burnt stone may represent single-episode events such as small fire-spots related to tree and scrub clearance, which would account for some medieval radiocarbon dates. The use of hot stones for pot-boiling has also been suggested, but the general lack of prehistoric pottery in excavated burnt mounds makes this unlikely. Bronze Age pots were often not robust enough to survive this type of treatment (Grogan *et al.* 2007; Seager-Thomas 2010). Connolly (2001) has suggested that spreads of burnt mound material at Darragh, Co. Clare, together with similar material from a number of sites in County Kerry, were spatially related to other monuments in the wider area, in particular, embanked enclosures. He suggests that they may have been related to ritual activities involving steam production or cooking in movable containers within the enclosures.

It is also likely that evidence for trough pits may have been removed by deep ploughing and recent drainage works, if they were not overlain and protected by burnt mound material. Therefore, it cannot be conclusively proven whether these deposits relate to a specific class of pyrolithic site in Ireland. The conclusion is that without excavation there is no clear distinction between those sites called fulacht fia (burnt mound and trough) and those described as burnt mounds (without troughs), as several factors could explain the absence of diagnostic features.

Types 6–7 Burnt mounds with structural evidence

Type 6 sites are defined by a number of characteristics (see above) such as large elongated troughs, formal hearths and substantial trough coverings or buildings. This evidence has been uncovered from at least 5 sites. Most of these have evidence for associated drainage features suggesting that water played an important role in their function. It has been suggested that they functioned as sweatlodges, using steam provided by a large body of heated water inside the structure. This interpretation, however, seems unlikely given that steam can be more easily provided by other means (this is discussed further in Chapter 7). The heat from the surface of these troughs, however, may have created an environment whereby steam was generated by proxy. As such, they may have had a dual purpose role where the steam provided the opportunity for secondary uses such as sweating or felting of textiles. The latter may have provided ideal conditions for waterproofing garments, which could have been suspended inside the structures (Jeffery 1991). While most of these sites are open-air facilities, the use of a building would have significantly reduced heat loss and so facilitated cooking in this type of large trough. The site is possibly another variant on the *fulacht fia* type, connected in this instance to larger output of food for feasting purposes, perhaps on ceremonial occasions. Comparisons can be made with these structures and stone-built structures such as those excavated in the Beara Peninsula Co. Cork (Site D, Barrees Valley), at Garranes and at Drombeg Co. Cork and Coarhamore, Co. Kerry (W.O'Brien 2009; Fahy 1960; Hayden 1994). These structures are associated with large internally recessed hearths and are interpreted as possibly representing specialised huts for cooking as at least two have internal stone-lined ovens.

Evidence of the variation within this site type is provided by what appears to be a genuine sweatlodge excavated at Rathpatrick Co. Kilkenny (KK19) (Type 7 sites). Other examples include those excavated at Burrow or Glennanummer Co. Offaly (OY08), Ballykeoghan Co. Kilkenny (KK49) and Blanchvillespark Co. Kilkenny (KK51). They are defined by large circular pits internally surrounded by stake-holes suggesting a light-domed structure possibly roofed with hides similar to examples found in North-Western America. The above-mentioned structures may relate to a different class of site employing similar pyrolithic technology for sweat-bathing.

Separately, there are a number of troughs displaying evidence of stake/post-holes in the immediate vicinity, with the possibility of a roofed or semi roofed structure associated with sweating or steam bathing. There are a number of problems associated with such interpretations. A small number of seemingly randomly placed stake-holes adjacent to troughs is not conclusive evidence of some form of canopy or covering as these may represent other ephemeral structures or site fittings.

Types 8–9 Burnt mounds with connected troughs

The identification of connected troughs is a relatively new phenomenon at excavated burnt mounds that has become particularly evident in recent years. As mentioned previously, a number of troughs are associated with water-channels associated with drainage, while others are connected to topographically lower pits reflecting another variant of water-management facilities, possibly functioning as cisterns/reservoirs in dryer areas (Cleary and Hawkes 2014). In other cases, they are connected to lower water-holes or wells providing a more readily

accessible water-source as opposed to nearby streams or rivers (see above).

Some channels can be connected to a series of features that imply not only the emptying of water, but the movement of water between pits in an organised fashion (Coughlan 2009; Hackett 2009a). Some are connected via water-channels such as Burrow or Glennanumer Co. Offaly (OY08), Ballybar Lower, Co. Carlow (CW10) and Cahiracon Co. Clare (CE20), while others abut each other such as the examples at Greenhills I, Co. Tipperary (TY70) and Tintagh Co. Roscommon (RM01). This may indicate that the product of the primary trough was fed in a controlled manner into a secondary and, in some cases, a third trough. Others have postulated that such features may reflect a production line of events in which each pit had a particular function (Tierney pers comm; Hackett 2009a). For instance, five of the six inter-connected pits at Greenhills 1, Co. Tipperary (TY70) are interpreted as functioning in unison relating to some kind of food processing. They may have held containers made from organic material as the pits themselves could not have held water as they were cut into sandy gravel subsoil.

As previously stated, it remains possible in some cases that these features represent multiple phases where sites were returned to and troughs/pits were re-cut in the same locations such as at Caherweeler 1 and 2, Co. Galway (GY25 and GY26) and Ballinillaun Co. Galway (GY20 and GY21). In other cases, however, a direct relationship seems reasonable where troughs were used concurrently, indicating a specific operation that required the movement of water between pits.

4.15 CONCLUSION

The variations in size and layout of these sites may partly be explained by post-depositional disturbance and alteration during more recent times. At the same time, archaeologists should be aware that the variations may be a manifestation of an adaptation of pyrolithic processes to changing functional demands, seasonal adaptations, local traditions or even the idiosyncratic tendencies of their users. We can no longer view these sites as representing simple water-boiling activities attested to archaeologically by a trough and a mound of burnt stone. Additional features identified in recent years suggest the technology was used in a number of different ways, the water-boiling process being just one of these. This, in turn, has led to obvious variations in the archaeological record, where we see features represented by short-term episodes of use. Conversely, the evidence at other sites suggests prolonged episodic use where sites were returned to time and time again. The tentative classification system applied here is by no means a definitive account of the varying technological features present in the archaeological record but may go some way to explain the observed differences noted. As noted by others (Gamble 2001: 22; Shanks and Tilley 1987: 10), the categories that we use to organise and label the past are important in managing large amounts of data, but they are only part of the story.

Another important conclusion drawn from the excavation record is that some sites display more structured spatial organisation than others. For example, the deliberate mounding of burnt stone with associated revetments at the shorter ends of rectangular troughs would certainly indicate a deliberate organisation of space. Similarly, the placement of formal hearths and other structural features in these same areas suggests an effective use of space, providing greater access to the more accessible sides of the trough. There can be two explanations for this. Firstly, the levels of visibility can be dictated by the percentage of site excavated, the degree of truncation or preservation and the types of features present. Many of the hearths, pathways/surfaces, drainage features and revetments that may have originally existed at a site are no longer archaeologically visible but those that do remain hint at a more complex society than was previously believed. Secondly, burnt mound users may have adopted different approaches to ordering space and not all of them may be obvious to our Western rationale. Fletcher, for example, in his discussion of settlement space concludes that settlement space appears to go through a cycle from absence of order, through order, to disintegration of spatial pattern (1984: 221). It certainly appears that the process of organising space on burnt mound sites was flexible and sometimes even site specific. This can be mirrored with the organisation of settlement space on Irish Bronze Age habitation sites where the structuring of space was a part of daily living (Cleary 2007: 222).

Part of the reason why pyrolithic sites engender debate is the equivocal nature of the physical evidence, and the fact that the term *fulacht fia* may cover a range of site types. Such variation is also connected to the long chronology of this site type, spanning three and a half millennia from the Late Neolithic to the beginnings of the Iron Age. Matters related to site variation and chronology are subjects of continued debate and will be considered further in the next chapter.

Chapter 5

Chronology

This chapter will outline the dating of burnt mounds and present an overall chronology of the site type in Ireland. The development of pyrolithic/water-boiling is considered, covering the period from the Early Neolithic to the end of the tradition sometime during the later first millennium BC. A critical analysis of radiocarbon evidence indicates that the use of pyrolithic technology was not particularly common during the Middle to Late Iron Age, and does not appear to have continued into the historic period. The chronological evidence is discussed further in Chapter 8 in relation to the cultural context of these sites.

5.1 INTRODUCTION

Issues relating to burnt mound chronology are of particular relevance to this study due to the broad date range to which these monuments are generally assigned. Prior to more scientific approaches to dating, burnt mounds were simply viewed as 'ancient cooking places' where hunting groups consumed their meat and slept in temporary shelters. These interpretations were based on a number of literary sources dating from the ninth to the eighteenth century AD, which associated the word '*fulacht*', or a derivative of this, to describe a cooking practice. During early investigations of these sites, a specific date was not usually assigned, but they were often interpreted as being related to the legendary *Fianna* and Fionn MaCumhail. This was popularised by Geoffrey Keating's seventeenth-century text, *Foras Feasa ar Éirinn*, which connected this type of cooking with such legends (see Chapter 2).

The first sites to be scientifically dated were those of Killeens and Drombeg in Co. Cork (O'Kelly 1954; Fahy 1960). The former was also the first archaeological site in Ireland to be dated using the radiocarbon method (O'Kelly 1954: 143). This provided an early indication of the use of these sites in the Bronze Age, though literary references to a similar cooking process led O'Kelly and later commentators to argue that the technology continued to be used into early historic times.

By the 1980s it was apparent that the majority of radiocarbon-dated sites were Bronze Age. An assessment of twenty-eight available radiocarbon dates in the late 1980s indicated that burnt mounds with associated troughs were particularly prevalent during the Middle Bronze Age and were not used to any great extent after *c.*500 BC (Brindley *et al.* 1989: 28). This suggests that the documentary sources for pyrolithic cooking were much later than the radiocarbon-dated contexts for burnt mounds in the field (Ó Drisceoil 1988; Brindley *et al.* 1989; Ó Drisceoil 1990). At that time, only a single Early Medieval radiocarbon date was known from an excavated burnt mound (Ryan 1990), with two others dated to the same period by supposed artefact associations (Sheehan 1990; Walsh 1990). A number of prehistoric radiocarbon dates for the Neolithic period were also dismissed on the grounds they were considerably earlier than the available dating evidence that placed these sites firmly in the Bronze Age (Brindley *et al.* 1989–90).

5.2 THE DATING OF BURNT MOUNDS

Burnt mounds are generally dated using absolute methods, due primarily to the absence of diagnostic material culture in excavated examples (see below). Because of this, radiocarbon dating is the most widely used chronometric technique owing to the abundance of charcoal and wood in these sites. Dendrochronology can also be used where trough linings and other wooden structures with mature oak survive. Fifteen wooden trough linings have been analysed by this method in Ireland, with the earliest example dating to 2852±9 BC at Jamestown, Co. Dublin (Brady 2000: 40). No burnt mounds have been dated using thermoluminesence in Ireland, but this method has been used to date burnt stone deposits in Britain and Scandinavia (Larsson 1990; Anthony *et al.* 2001; Anthony 2003).

The use of relative methods to date burnt mounds can be problematic. As mentioned previously in Chapter 4, typological sequences have been proposed with regard to trough development, with circular forms dating from the Early Bronze Age and rectangular ones from the later Bronze Age (Ó Néill 2000a: 19). It has been argued, however, that there are too many exceptions to make this a useful dating application, though certain patterns do exist in relation to trough linings (Hawkes 2015b; see Chapter 4).

Artefacts as chronological indicators

While artefacts are a valuable source of dating information, the number of finds from Irish burnt mounds is remarkable small relative to the size of the excavation sample. Moreover, many finds are not particularly diagnostic, providing only broad date ranges. Ó Néill's study records that of a total of 832 records from excavations of burnt mounds, only 163 sites produced artefacts (2009: 167). This material typically consists of worked flint and flaked stone, ceramics, stone tools, dress objects and faunal

remains (*ibid*.: 168). The artefact evidence from burnt mounds is explored further in Chapter 7, however, a brief overview is offered here in relation to dating evidence.

Ó Néill noted that the most commonly associated finds are flaked stone, pottery and animal bone. Excluding animal bone, the current study revealed that 375 burnt mounds excavated between 1950 and 2010 produced artefacts (Appendix 1: Figure 10.11). Flaked stone tools are the most common, with 268 sites producing small assemblages of worked flint or chert. This is followed by coarse stone assemblages consisting of hammerstones, pounders, rubbing stones, grinding stones, hones/whetstones, mortars and pestles. A total of 51 excavated sites produced such artefacts. They are generally poor chronological indicators and their dating relies to a large degree on an association with more accurately dated finds or associated radiocarbon dates. Contextually, most artefacts have been recovered from burnt stone deposits (42%), followed by pits (12%), troughs (7%), post-holes (3%) and other possible associated deposits and features (26%) (Figure 5.1).

A total of 18 saddle querns are recorded from burnt mounds in Ireland, with the majority either from burnt mound material or trough fills dating to the Middle to Late Bronze Age. These are the most common diagnostic artefacts recovered from burnt stone deposits in Ireland after pottery and flaked stone tools. At Ballyduff East, Co. Waterford (WD22), for example, a portion of a quern stone and an associated rubbing stone were recovered from a large timber-lined trough dated to the Middle/Late Bronze Age (Hegarty *et al.* 2011: 21–4). There are parallels at Drombeg, Co. Cork (CO07), where a complete quern stone was reused as a covering slab for an overflow drain linked to a well (Fahy 1960). Traditionally seen as an early medieval artefact, spindle whorls and stone discs are becoming increasingly evident in Bronze Age contexts in Ireland (R. O'Brien 2009). Seven spindle whorls and seven stone discs have been recovered from burnt mounds in Ireland. This includes a decorated spindle whorl recovered from the fill of a Late Bronze Age stone-lined trough at Coarhamore, Co. Kerry (KY03; Sheehan 1990). A similar object was recovered from a burnt mound at Holdenstown 4, Co. Kilkenny (KK37) (Whitty 2011).

A total of 40 sites have produced prehistoric pottery, which can be dated to varying degrees. For instance, Beaker pottery is very distinctive and has been recovered from a number of burnt mounds with supporting radiocarbon evidence. These include Ask, Co. Wexford (WX05), Graigueshoneen, Co. Waterford (WD07) and Ballycloge North Co. Wicklow (Bower 2010; Johnson *et al.* 2008; Whitty 2009).

Diagnostic metal finds recovered from burnt mounds can also be good chronological indicators however they are rarely found. The remains of three bronze axeheads have been recovered from excavated sites in recent years, all broadly comparable to the radiocarbon evidence on site (see below). Examples include those found at Ballynakelly, Co. Dublin (DN31), Camlin 1, Co. Tipperary (TY69), and Ballynapark, Co. Wicklow (WW21). Similarly, the gold finds from radiocarbon dated sites at Rathmore, Co. Wicklow (WW07) and Ballymaclode, Co. Waterford (WD30) can be typologically dated to the Late Bronze Age (McLoughlin 2001; Cahill 2009). The stone tool assemblages from recent road schemes can also be dated typologically and/or technologically dated to the Bronze Age, consistent with the radiocarbon dating of these sites.

While burnt mounds are not known for large numbers of lithic artefacts, this study has revealed that 268 sites have produced such material. In a number of cases, the presence of numerous waste flakes indicates that flint knapping took place on site. Some 51 sites were found to contain a number of waste flakes or débitage. Some assemblages contain a sufficient number of typologically diagnostic artefacts to attribute individual artefact groups within a single assemblage to particular periods. In many cases these are consistent with the radiocarbon dates retrieved, though in some cases the material is earlier or later (see Chapter 7). The diagnostic flaked stone artefacts include barbed and tanged arrowheads (15 sites), scrapers (83 sites) and blades (38 sites). Both the discarded scrapers and the associated re-sharpening flakes suggest that hide-processing and wood working may have been carried out at these sites (Sternke 2009: 30). Green and Zvelebil (1990: 65) observed that in the Bronze Age 'flint takes on a less distinct or definable function', while O'Hare (2005) pointed to a significant decrease in the range of stone tool types in that period. The occurrence of small convex scrapers is not necessarily a reliable indication of a Bronze Age date (Woodman *et al*. 2006). Thus, the dating of Middle and Late Bronze Age assemblages relies on other aspects such as the occurrence of diagnostic macro tools (e.g. saddle querns, large rubbing stones, some types of hones and spindle whorls) and their association with other artefact types and/or evidence of metal-working. In addition, it is difficult to separate Early Bronze Age from Middle Bronze Age material based solely on technological characteristics (Sternke 2013: 336).

The recovery of artefacts from some 375 excavated burnt mounds is in stark contrast to the situation up to the late 1980s when only 22 sites in Ireland produced such finds (Cherry 1990: 49). While this number has risen considerably as a result of rescue excavation over the last decade, the problems identified by Cherry continue to be context and association. This is particularly problematic for lithics, often recovered from these sites. In many cases this material is recovered from topsoil or levelled burnt mounds. The paucity of well-stratified artefacts from burnt mounds has limited the value of relative methods for dating these sites. For instance, many sites have produced post-medieval pottery and more recent artefacts as a result of disturbance from ploughing and the digging of field drains.

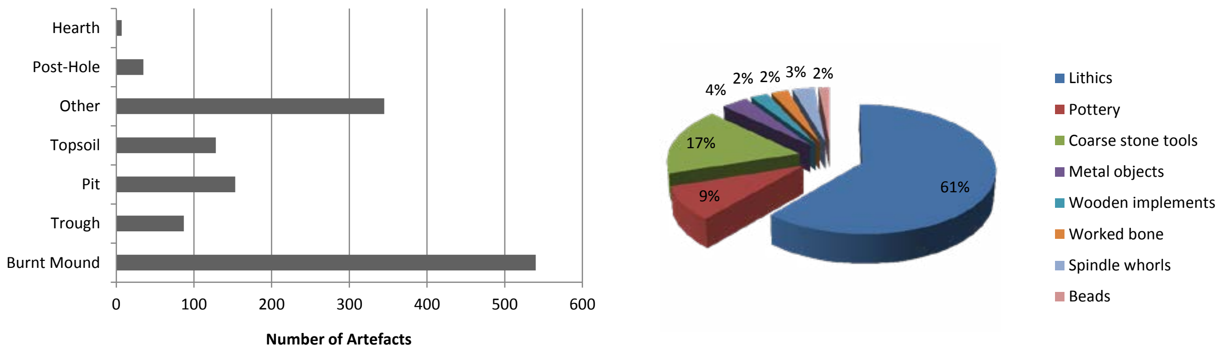

FIGURE 5.1: CONTEXT AND RANGE OF MATERIAL CULTURE FROM BURNT MOUNDS IN IRELAND.

A number of high-status medieval artefacts such as bronze stick pins, brooches were recovered from burnt mound sites such as at Crabbsland, Co. Limerick (LK19), Ballyman, Co. Dublin (DN01), and Townparks, Co. Meath (MH81), while a bronze ladle was recovered from Ballynapark Co. Wicklow (WW35). Excavation has shown that these artefacts relate to different phases of activity that incorporated later artefacts into earlier burnt mound deposits. Early prehistoric artefacts have also been recovered during the excavation of burnt mounds. These are mostly lithic finds, none of which recovered from secure contexts. They comprise 15 Mesolithic finds including a butt-trimmed form of Late Mesolithic type 'Bann Flake' retrieved from a burnt mound at Johnstown, Co. Carlow (CW05). This was interpreted as a stray find unrelated to a burnt mound that is securely dated to the Early Bronze Age (O'Connell 2009). A distally trimmed point/borer of Late Mesolithic form was recovered from a metalled surface under a burnt mound at Inchaquire, Co. Kildare (KD23). This find is possibly associated with the re-deposition of material during construction (Hanbidge 2009).

Neolithic material culture has also been recovered from Bronze Age burnt mounds. These include a number of polished stone axes recovered from topsoil, burnt mound material or underlying peat deposits. Even though these examples are from unstratified contexts unrelated to later Bronze Age burnt mounds, they do indicate repeated occupation of areas where burnt mounds typically occur. Most represent probably earlier material incorporated into later contexts. Although stone axes were used into the Bronze Age, few have been recovered from secure burnt mound deposits. That being said, stone axes have been recovered from a number of earlier burnt mounds including Clowanstown I, Co. Meath (MH82), dating to the Neolithic and Aghnahunshin, Co. Leitrim (LM10), dating to the Chalcolithic.

Absolute dating techniques and a revised grading system

Radiocarbon analysis remains the mostly widely used absolute method to date burnt mounds due to these issues. It is successful due to the survival of organic material, including:

1. Plank, brushwood and wicker trough linings, along with hollowed-out tree trunks used as water troughs

2. Charcoal produced as a residue of roundwood fuel used to heat stones

3. Animal bones believed to be food waste from the use of these sites

4. Wood and charcoal connected with associated settlement structures

5. The dating of peat growth below or above burnt mound contexts

6. Plant remains such as hazelnut shells and cereal grains.

As with any archaeological excavation, the selection of datable organic material from a secure context is important. Ideally, where wooden trough linings survive, these should be sampled for radiocarbon dating. If preservation does not allow for this, carbon-containing material should be selected from deposits linked to the use of pyrolithic/water-boiling technology, i.e. primary trough fills or undisturbed burnt mound deposits. As many sites are uncovered as dispersed spreads of burnt stone, selecting samples from securely stratified contexts can be problematic. Burnt mounds are vulnerable to different types of ground disturbance and have suffered greatly from agricultural disturbance over the centuries. Previously unrecorded burnt mounds have been uncovered on recent road schemes as levelled spreads of heat-shattered stone and charcoal. In this regard, the excavator must be aware of the possibilities of contamination or admixture of the sample.

A number of aspects should be considered prior to the selection of the sample (after Brindley and Lanting 1994: 282):

(a) The possibility that identical material of a different age is mixed with the sample

(b) The age of the sample material itself (own-age)

(c) The degree of certainty of association.

In his influential study on formation processes of the archaeological record, Schiffer (1972; 1976; 1987) discussed in detail the context of things uncovered and the ways in which the past does not come to us unchanged. He divided formation processes into cultural agencies, where the process of human behaviour alters material remains in the ground (C-transforms), and natural agencies that stem from processes of the natural environment (N-transforms) (Schiffer 1987: 7). In the case of radiocarbon dating a burnt mound, a number of natural processes can affect the integrity of an archaeological context prior to sampling. These include contamination with older organic matter such as peat and also the infiltration of younger organic material through root penetration. In addition, the admixture of foreign material through soil processes or micro-fluvial activity or falling trees can account for problematic samples. Intrusive carbon may also enter a sample through root channels or surface fires (Mook and Waterbolk 1985: 29–33).

Radiocarbon samples may also have become contaminated through human contact during or after sampling. This may occur during the collection of charcoal where material from other layers become mixed with the sample (Mook and Waterbolk 1985: 32). The possibility of contamination is obviously greater for samples that lie close to the modern surface. This may have been the case at a burnt mound at Corrin, Co. Cork (CO46), where a modern radiocarbon date was obtained. The mound was heavily truncated, which led the excavator to suggest the sample was contaminated (O'Connell 2006). Similar problems arose in the dating of sites at Derrygarrif, Co. Clare (CE57), and Richmond, Co. Tipperary (TY23).

Although chemical pre-treatment can remove some of these contaminants, the 'own age' of a sample is another important factor. It is not unusual for wood or wood-charcoal to have an 'own-age' of more than half a century, although 'own-ages' of more than a century are not very common (Lanting 2004: 310). The dating of old wood has occurred at a number of prehistoric burnt mounds in Ireland, producing a range of unreliable radiocarbon dates. These include Ballycahane Lower, Co. Limerick (LK04) (Brindley *et al*. 1989–90), Ballyvass, Co. Kildare (KD30) (Doyle 2010), and Coolderry, Co. Tipperary (TY35) (Long 2009) (see Hawkes 2014).

A very important factor in the dating of burnt mounds is the degree of association between the sample and the context being dated. A recent study has demonstrated that a significant portion of later prehistoric radiocarbon dates from both commercial and other excavations are problematic in terms of their sample and/or association quality (Becker *et al.* 2012). This has been supported by a review of radiocarbon dates of medieval age from Irish burnt mounds, which are now disregarded on the grounds that the association between the sample and the context being dated is not secure (Hawkes 2012; see below).

The sample submitted for radiocarbon dating must be recognised as being directly related to an activity associated with a pyrolithic technology. Dated contexts that fall outside these parameters cannot be reliably associated with such a process. A critical review of the recent radiocarbon evidence was undertaken using a grading system outlined by Mook and Waterbolk in 1985. This is based on the degree of certainty of the dated sample and its association with pyrolithic activity. The following is a classification of radiocarbon samples from burnt mounds based on the degree of certainty of association (after Mook and Waterbolk 1985):

A. ***Full certainty***. The wood or charcoal sample comes from a structural feature of the site connected with a pyrolithic/water-boiling technology. Examples: wood used to line a trough; charcoal from primary context within formal hearth features.

B. ***High probability***. There is a direct functional relationship between the wood/charcoal/bone being dated and the use of pyrolithic/water-boiling technology in the site. Example: fuel residue (charcoal) or animal bone food waste from undisturbed position in the burnt mound or trough.

C. ***Reasonable probability***. There is no demonstrable association between the material being dated and the use of pyrolithic/water-boiling processes in the site, however the sample comes from an associated structure/activity. Example: charcoal/wood/bone from stake- or post-hole of a structure or pit.

D. ***Low probability***. The possibility exists through spatial proximity of some connection between the sample material and the use of pyrolithic/water-boiling processes in the site, however this cannot be confirmed.

E. ***No association***. There is no definite stratigraphic or functional connection between the material being dated and the use of pyrolithic/water-boiling processes in the site.

The current study has established that charcoal is the most common material dated from burnt mounds (90%), followed by waterlogged wood (9%), bone (1%), and other materials such as peat and hazelnut shells (Figure 5.2). Contextually, the material has derived from trough fills (40%) and related structural timbers (8%), burnt mound material (27%), pit fills (19%), hearths (1%), associated stake/post-holes (2%) or from other structures and associated deposits (3%). A critical review of these radiocarbon dates was undertaken using the grading system outlined by Mook and Waterbolk (1985), and which was successfully used elsewhere in relation to other dated burnt mounds (Hawkes 2012; 2014). This is based on the degree of certainty of the dated sample and its association

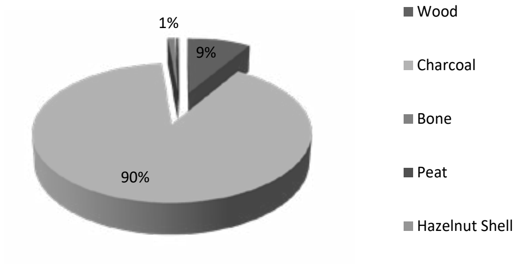

FIGURE 5.2: SAMPLE MATERIAL DATED FROM BURNT MOUNDS IN IRELAND.

with pyrolithic activity (see tables below and Appendix 1 for grading assignment).

The adoption of the above grading system is particularly useful in demonstrating whether the sample from a burnt stone site can be regarded as reliable, particularly where the radiocarbon date obtained was perhaps outside the assumed age of the site. To develop a detailed chronology for a burnt mound a sufficient number of samples are needed, ideally with clear stratigraphic relationships, so that new refined dating programmes such as Bayesian techniques can be applied to further constrain the calibrated ages (Barratt and Reimer 2007: 8). Unfortunately, out of some 800 radiocarbon-dated sites, only 273 examples have two or more samples dated.

5.3 OVERALL CHRONOLOGY

As mentioned previously, radiocarbon dates are the predominant type of dating evidence for sites considered in this study. Only in a small number of cases were sites dated through artefactual evidence and dendrochronology. As outlined above, it was attempted to obtain as much detailed information on sample origin, including both wood identification, and association of sample. In some cases such information on sample quality and origin may not be readily available as part of the site reports. On many rather complex sites only individual features were dated. As a result, their stratigraphic relationship to the remainder of the site is often unclear and therefore their contemporaneity is only possible at best.

Dealing with the essential complete creation of a narrative for a cultural period requires the consideration of chronological markers and subdivisions (Becker *et al.* 2008). The chronological framework used in the present study corresponds with that set outlined by Waddell (2000) with a number of amendments (after O'Brien 2012a; Figure 5.3). The following subdivision of the period used in this project was therefore adopted, which is taken as a working categorisation of the Irish prehistoric period. However, it is recognised that these 'divisions' raise many questions and problems and can vary between publications.

Similar to studies conducted in Scotland (Anthony 2003), the available radiocarbon dates from Ireland can be split into two categories: those for which single dates are available, and those for which a more comprehensive dating strategy was followed, where funding allowed numerous features to be dated. Since Ó Néill (2009: 33) cautioned against the use of mixed-entity sampling, there has been a move away from bulk charcoal dating to that of single-entity AMS dates on short-lived identified material. This raises a potential problem specific to burnt mounds, relating to large voids formed due to the coarse stony nature of the burnt mound deposits. Such spaces allowed the filtration of small charcoal and seeds down through the deposits in a process known as pedoturbation (Hedges and Gowlett 1986; Schiffer 1987). This should be borne in mind when interpreting radiocarbon dates from specific areas of a site (Anthony 2003). In most cases, however, it is possible to sample large fragments of charcoal and for wood from relatively closed contexts in these burnt mounds. It must be emphasised that multi-context dating is important in order to establish an overall chronology for a site.

PREHISTORIC PHASES	APPROXIMATE DATES
EARLY MESOLITHIC	*c.*7800–6000 BC
LATE MESOLITHIC	6000–4000/3800 BC
EARLY NEOLITHIC	3800–3400 BC
MIDDLE NEOLITHIC	3400–3000 BC
LATE NEOLITHIC	3000/2900–2500 BC
CHALCOLITHIC	2500–2100 BC
EARLY BRONZE AGE	2100/2000–1600 BC
MIDDLE BRONZE AGE	1600–1200 BC
LATE BRONZE AGE	1200–800 BC
EARLY IRON AGE	800–400 BC
MIDDLE IRON AGE	400 BC–AD 100
LATE IRON AGE	AD 100–400

FIGURE 5.3: PERIODIZATION OF IRISH PREHISTORY. SOURCE: AMENDED FROM WADDELL 2000.

It can be demonstrated through the existing radiometric data that a number of sites had a prolonged duration of use. This, in turn, has led to uncertainty in the way in which 'spot' dates should be interpreted. There is also clear evidence that burnt mounds can no longer be regarded of as solely Bronze Age (Hawkes 2014). There is evidence for their use over some four millennia while the technology itself may even be earlier (see below). The present study indicates that the predominant peak of burnt mound activity takes place in the Bronze Age. However, it is by no means confined to this period as examples exist from the Early Neolithic period through to the Early Iron Age. There is a notable decline in the use of pyrolithic technology during the Middle Iron Age while a critical review of the later Iron Age and medieval dating evidence suggesting a complete absence. This is in complete contrast to previous studies that have proposed a complete cessation of burnt mound activity by the last quarter of the first millennium BC with a re-emergence again in the middle of the first millennium AD (Ó Néill

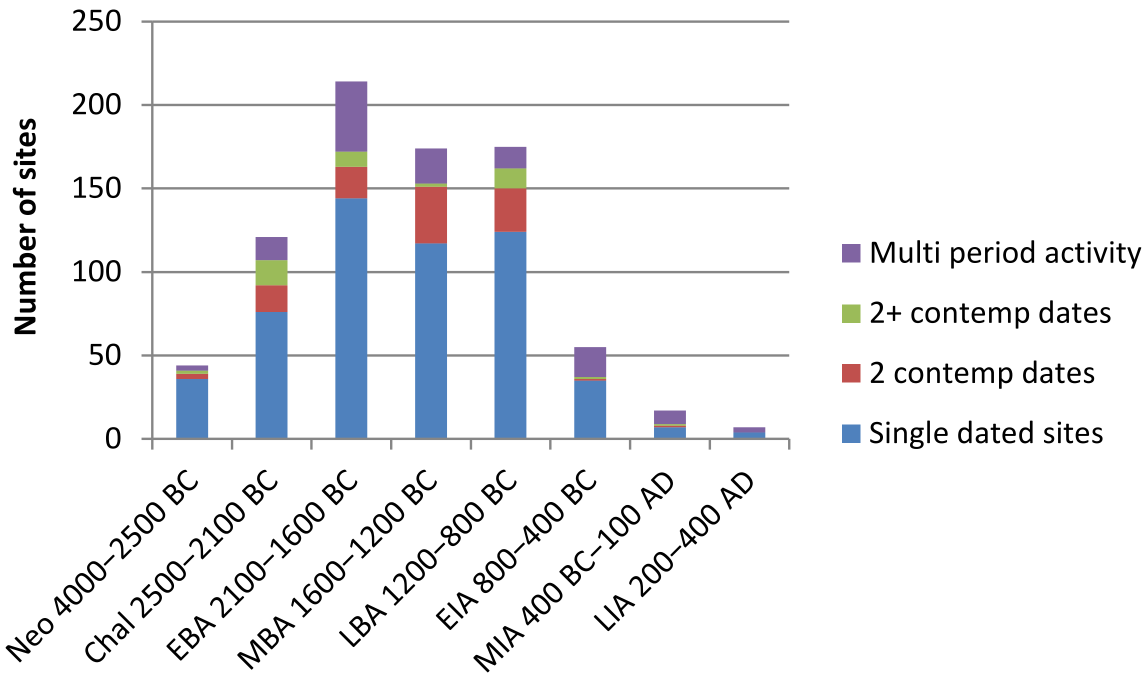

FIGURE 5.4: RANGE OF RADIOCARBON DATES FROM BURNT MOUNDS IN IRELAND.

2009: 40). Analysis of approximately 1014 radiocarbon dates from Ireland demonstrate the use of pyrolithic water-boiling technology from the Early Neolithic onwards with a clear concentration of use during the Early to Middle Bronze Age. The dating evidence presented below was produced by separating all burnt mounds dated by a single radiocarbon/dendrochronological samples from those sites that have produced more than one broadly contemporary date and those that display multi-period activity (Figure 5.4).

5.4 THE BEGINNINGS OF THE BURNT MOUND TRADITION

The earliest archaeological evidence of humans living in Ireland comes from the Mesolithic *c.*8000–4000 BC, when hunting and foraging groups survived by exploiting seasonal resources throughout the landscape. No burnt mounds are dated to this period; however, four sites have produced Mesolithic radiocarbon dates (see below). The study reveals that there was no burnt mound tradition in Mesolithic Ireland comparable to Bronze Age examples. Where Mesolithic radiocarbon dates are recorded, these can be shown to have no association with pyrolithic technology. These examples probably represent contaminated samples, such as Ballyvass Co. Kildare (KD30) and Coolderry 2, Co. Tipperary (TY35), or earlier unrelated activity, such as at Ballycahane Lower, Co. Limerick (LK04) and Flemby Co. Kerry (KY07). This is supported by Bronze Age dates from more secure contexts in the same sites that are more likely representative of their true age.

Burnt and fire-cracked stone has been identified at some Mesolithic sites in Ireland, suggesting that some version of pyrolithic technology may have been employed for roasting or small scale boiling as part of food preparation. For instance, burnt stone has been identified at several Mesolithic shell middens with some recognising it as a characteristic feature of these sites (O'Sullivan and Downey 2005; McCormick *et al.* 1996). Deposits of burnt and fire-cracked stone were also uncovered at Ferriter's Cove, Co. Kerry during excavations of a Late Mesolithic coastal site (Woodman *et al.* 1999). The small spreads of burnt stone were interpreted as the waste product from possible roasting of food. A pit from one of these areas where burnt stone was identified is dated 4225–3965 BC (Q-2641). A similar date was recently retrieved from a burnt stone and shell midden deposit on the shores of Fanore More, Co. Clare (Michael Lynch pers. comm.). Burnt stone and charcoal was noted in two Mesolithic shell middens excavated by Mitchell at Rockmarhshall, Co. Louth (1947; 1949), possibly indicating the early use of hot stones in a cooking process similar to Ferriter's Cove. Burnt stone was also recognised at a Late Mesolithic site on the shores of Lake Derravaragh, Co. Westmeath (Mitchell 1972). Aimeé Little (2014) has recently argued that the technology may have been used for the processing and cooking of plant remains during the Mesolithic.

With regard to a Neolithic burnt mound tradition, Quinlan (1885) was the first to suggest that burnt mounds may date to this period. His investigations of a burnt mound site at Clonkerdon, Co. Waterford, produced a hollowed-out tree trunk used as a water trough and an adjacent hearth structure. In the absence of absolute dating methods, Quinlan dated the site to the Neolithic by the recovery of three stone axeheads found nearby. The National Museum of Ireland records these as bronze axeheads of later Bronze

Age date (Cherry 1990), even though there is no direct association, the burnt mound also.

Deposits of heat-shattered stone have also been recovered from sites containing diagnostic Neolithic material culture, such as pottery and flint tools. For instance, burnt stone found with sherds of possible Neolithic pottery was found at Rockbarton Bog, Co. Limerick (Mitchell and Ó Ríordáin 1942/43), while heat-affected stone was recognised along with similar material culture at Geróid Island, Lough Gur, also in Co. Limerick (Liversage 1958). Two spherical clay objects were recovered from the base of a trough at Webbsborough, Co. Kilkenny (Prendergast 1955). As the site was not scientifically dated, the excavator drew parallels with similar objects found in Irish passage tombs dated to the Middle Neolithic period.

By the mid 1990s the earliest and most securely dated burnt mound in Ireland was Ballynoe, Co. Cork (CO11; Figure 5.5). A timber fragment from one of the trough planks is radiocarbon dated to the Chalcolithic, 2459–2206 BC (GrN-11803) (Lehane 1988). It has been suggested that the emergence and popularity of these sites at this time may have been connected with a greater awareness of the power of heat and hot stone technology, heightened by its application to mining and metallurgical processes (Brindley 1995: 8). However, it is now evident that the technology was present in Ireland considerably earlier than the beginnings of metallurgy. Traditionally seen as a Bronze Age tradition in Ireland, there are now various examples of burnt mounds of Neolithic date. Some fourteen sites have been dated to the Early to Middle Neolithic period, *c.*4000–3000 BC, with a further twenty eight sites dating to the Late Neolithic, *c.*3000–2500 BC.

To summarise, an examination of the evidence reveals that out of 51 early prehistoric dates from 46 sites, 18 can be securely connected with the type of pyrolithic/water-boiling process known from burnt mounds, while a further 18 sites were possibly associated with similar activity. The remaining ten contexts have no association with the use of pyrolithic technology, and these include five Mesolithic radiocarbon dates from four burnt stone deposits.

A total of 50 early radiocarbon dates and one sample dated by dendrochronology have been obtained from over 1,000 excavated burnt stone deposits in Ireland (Figure 5.6). Of the potential Neolithic sites, five can be positively dated to 4000–3000 BC (Figure 5.7), with a further 24 dating to 3000–2500 BC. The radiocarbon samples from a further five sites have no association with the use of pyrolithic technology, being either intrusive elements to the site

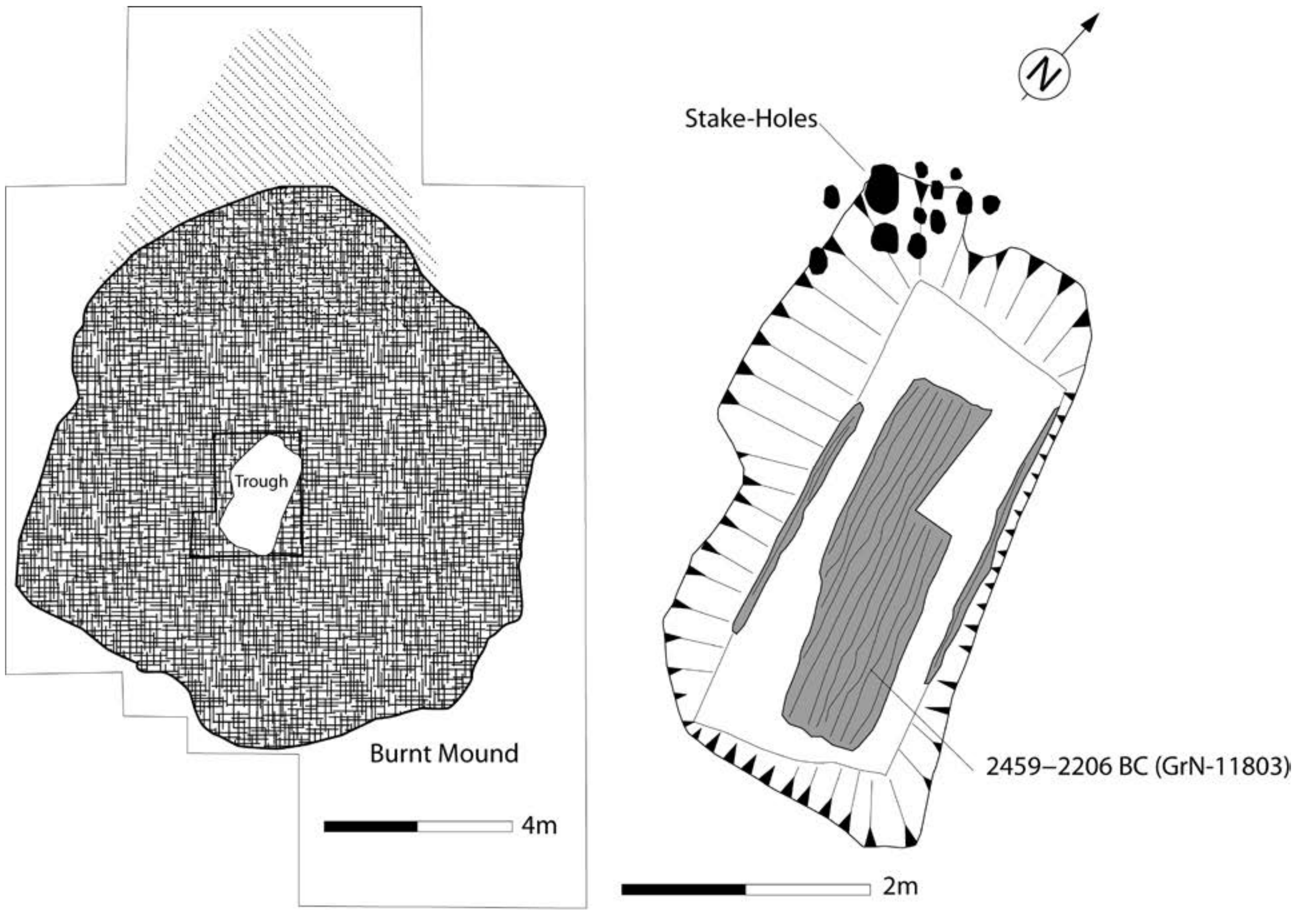

Figure 5.5: Burnt mound dated securely to the chalcolithic period at Ballyclogh, near Ballynoe, Co. Cork. Source: adapted from Lehane 1988.

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
LK04	Ballycahane Lower	Limerick	Peat Layer (wood fragments)	7029–6604 BC	E
			Peat Layer (wood fragments)	5036–4798 BC	E
KD30	Ballyvass	Kildare	Burnt Mound (wood)	4583–4401 BC	E
TY35	Coolderry 2	Tipperary	Trough (wood)	4364–4263BC	E
KY07	Flemby	Kerry	Burnt Spread (charcoal)	4230–3799 BC	E
KD10	Cherryville 7	Kildare	Burnt Spread (charcoal)	4219–3714 BC	B
			Burnt Spread (bone)	3634–3366 BC	B
MH05	Moorechurch 1	Meath	Burnt Mound (charcoal)	3971–3667 BC	A
			Pit fill (charcoal)	3637–3120 BC	A
MH82	Clowanstown 1*	Meath	Trough fill (charcoal)	3960–3780 BC	A
NC	Ballintotty	Tipperary	Burnt Mound (charcoal)	3780–3641 BC	E
WD23	Carriganard	Waterford	Burnt Mound (charcoal)	3793–3649 BC	E
MH58	Pottlebane 3	Meath	Trough fill (charcoal)	3770–3637 BC	B
WM49c	Ballykilmore 5.1	Westmeath	Burnt Mound (charcoal)	3695–3530 BC	B
			Burnt Mound (charcoal)	3324–2927 BC	B
WM50	Cappanrush 1	Westmeath	Trough fill (charcoal)	3640–3384 BC	L
CO49a	Fermoy 2	Cork	Pit fill (charcoal)	3517–3027 BC	C
MH83	Clowanstown 2	Meath	Pit fill (charcoal)	3496–3103 BC	B
MO41	Ballyglass West	Mayo	Burnt Mound (charcoal)	3494–2920 BC	C
LK09	Cloghaclocka	Limerick	Trough (timber)	3485–3110 BC	D
KD09	Cherryville 6	Kildare	Peat layer (bone)	3356–2936 BC	E
NC	Annaholty 5	Tipperary	Pit fill (charcoal)	3352–3102 BC	C
KK26a	Islands	Kilkenny	Trough timber	3011–2761 BC	A
			Trough fill (charcoal)	2886–2500 BC	A
TY41b	Gortybrigane	Tipperary	Burnt Mound (charcoal)	2880–2620 BC	D
LS31	Corraun	Laois	Pit fill (charcoal)	2872–2579 BC	C
MH44	Ballinter 2	Meath	Pit fill (charcoal)	2875–2500 BC	C
MO49	Sonnagh	Mayo	Burnt Mound (charcoal)	2871–2498 BC	B
WM05	Enniscoffey	Westmeath	Trough timber	2873–2496 BC	A
WM12	Newdown	Westmeath	Burnt Mound (charcoal)	2876–2492 BC	B
MO27	Gortaroe	Mayo	Trough fill (charcoal)	2860–2498 BC	B
KD25	Ballymount	Kildare	Post-hole (charcoal)	2859–2497 BC	C
GY14a	Doughiska	Galway	Wood (natural)	2861–2492 BC	E
MO27	Gortaroe	Mayo	Trough fill (charcoal)	2858–2496 BC	B
LS09	Aghmacart	Laois	Spread (charcoal)	2861–2492 BC	C
WM39	Kilbeg	Westmeath	Pit (charcoal)	2859–2486 BC	C
LK65b	Richill site B	Limerick	Pit (charcoal)	2836–2493 BC	C
MO45b	Smuttanagh	Mayo	Trough fill (charcoal)	2852–2476 BC	B
LS46	Springfield 3	Laois	Pit fill (charcoal)	2866–2469 BC	C
MH77b	Kennastown	Meath	Spread (charcoal)	2852–2476 BC	C
MH49	Boyerstown 8	Meath	Trough fill (charcoal)	2851–2472 BC	B
TY35	Coolderry 2	Tipperary	Trough timber	2828–2480 BC	A
MO17	Deerpark East	Mayo	Trough fill (charcoal)	2840–2469 BC	C
MH75b	Gainstown 1B	Meath	Pit fill (charcoal)	2833–2466 BC	C

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
MH51	Blundelstown	Meath	Trough fill (charcoal)	2832–2462 BC	B
MO57	Tomboholla	Mayo	Burnt Mound (charcoal)	2834–2300 BC	B
WW31	Scratenagh	Wicklow	Post-hole (charcoal)	2849–2145 BC	C
CO43	Ballinaspig More 7	Cork	Burnt Mound (charcoal)	2866–2493 BC	B
DN32	Jamestown**	Dublin	Trough timber	2859±9	A
SO17	Magheraboy	Sligo	Pit fill (charcoal)	2857–2467 BC	C
MO28	Gortaroe Area 4	Mayo	Trough timber	2577–2479 BC	A

Figure 5.6: Mesolithic and Neolithic radiocarbon dates from burnt stone deposits in Ireland (calibrated at 95.4% confidence)
* Numerous dates available **Dendrochronology date NC=not catalogued.

or representing activity pre-dating the formation of the burnt mound. Seven sites cannot be securely related to a pyrolithic boiling process as no troughs were encountered, though the site records indicate an activity associated with roasting or steaming.

Diagnostic material culture has also been retrieved from some of these Neolithic burnt mounds. The presence of Early Neolithic carinated bowl pottery at Clowanstown 1, Co. Meath (MH82) and Cherryville 7, Co. Kildare (KD10) places these sites firmly within the early stages of the fourth millennium BC. A leaf-shaped arrowhead from Cherryville, and the polished bone pins and axheads from Clowanstown, further support the radiocarbon dates. A siltstone projectile head was recovered adjacent to the burnt stone spread at Ballyglass West, Co. Mayo (MO41). Dating this type of arrowhead is problematic, however a broad Early Bronze Age date has been suggested (Finlay 2010: 22).

Artefacts were recovered from six sites dating to 2800–2500 BC. All of this material was recovered from deposits of heat-shattered stone and consists entirely of flint and chert, except for finds at Claristown 1, Co Meath (MH06). A possible stone pestle was recovered from the base of a trough and was interpreted as a deliberate votive deposit (Russell and Corcoran 2001). Flint and chert scrapers were uncovered at Gortaroe, Co. Mayo, Blundelstown, Co. Meath (MO28 and MH51), while two convex end-scrapers were retrieved from Gainstown 1, Co. Meath and Ballymount Co. Kildare (MH75b and KD25). All of these examples were tentatively suggested as being contemporary with the radiocarbon evidence, possibly being used in the processing of animal carcases. Possible débitage material was also recovered from Ballymount Co. Kildare (KD25) and Mullamast Co. Kildare (KD21), however this material was recovered from unstratified contexts.

Troughs found at three sites can be securely dated to the Early Neolithic period (4000–3600 BC). This suggests that the heating of water using hot stones was practiced at this early stage in Ireland. These troughs varied in size and shape, however there is no evidence that any were lined with wood or stone. All produced substantial deposits of heat-shattered stone. It appears that boiling troughs began to be timber-lined during the Late Neolithic period in Ireland. This is supported by radiocarbon dating of four trough timbers to the period 2800–2500 BC. These include the sites at Coolderry, Co. Tipperary (TY35), Enniscoffey, Co. Westmeath (WM05) and Gortaroe 1 Area 1 and 4, Co. Mayo (MO27 and MO28). A fifth site, Jamestown, Co. Dublin (DN32), produced a timber trough dated by dendrochronology to 2852 ± 9 BC (Q9783) (Brady 1998).

The Late Neolithic troughs were rectangular in shape and lined with timbers of ash, oak and alder, with additional hazel stakes for supports (Figure 5.8). On average these pits measured 1.4m by 1.1m in size and up to 0.2m in depth. Split plank linings were noted at Coolderry, Co. Tipperary (TY35), Enniscoffey, Co. Westmeath (WM05) and Islands, Co. Kilkenny (KK26a), while a wicker division is recorded in a trough at Gortaroe, Co. Mayo (MO28) (Figure 6.9). Only the base of a brushwood trough survived at another burnt mound excavated at Gortaroe Area 4, Co. Mayo (MO27) (Gillespie 2001). At this site, twenty-six willow sticks formed the base of the trough, some of which seemed to have been worked with stone implements. The most unusual of these early timber troughs is Sonnagh III, also excavated in Co. Mayo (MO49; see Gillespie and Kerrigan 2010). A single, tangentially split alder plank in the base of the trough was held in place by two hazel rods at either ends. It was interpreted as either the remains of a possible seat for bathing or a platform for keeping food produce elevated from the floor of the trough during the cooking process (*op cit*. 75–6).

It was previously suggested that troughs began to be lined sometime after 2000 BC (Ó Néill 2000a). In the light of recent excavations we can now confirm that this practice occurred at an earlier date. To date, no stone-lined troughs have been identified at sites dating to the Neolithic period. Definitive hut-structures are also absent from the archaeological record. Although a number of stake-holes were recorded at Ballymount Great, Co. Kildare (KD25), Scratenagh, Co. Wicklow (WW31) and Gainstown 1B, Co. Meath (MH75), none of these can be interpreted as the remains of hut-structures.

Figure 5.7: Early Neolithic burnt mound at Clowanstown, Co. Meath. Source: Matt Mossop for ACS Ltd and Transport Infrastructure Ireland.

Figure 5.8: Late Neolithic trough at Enniscoffey, Co. Westmeath. Source: Grogan *et al.* 2007.

Only one certain hearth of Neolithic date was identified at Ballinaspig More 7, Co. Cork (CO43), but this may relate to any phase of activity on the site. A concentration of charcoal located east of the timber-lined trough at Enniscoffey, Co. Westmeath (WM05) may be associated with a hearth or fire. Like many other burnt mounds, hearth locations are difficult to identify during excavation. However, the presence of large amounts of charcoal and firing debris at suggests that significant fires would have been burnt during each episode of use (Chapter 4).

5.5 THE BRONZE AGE TRADITION

Radiocarbon dates obtained in 1953 for a trough at Killeens Co. Cork (CO04), the first ever for Irish archaeology, gave the first real indication that burnt mounds in Ireland were Bronze Age (O'Kelly 1954). This is supported by subsequent excavation evidence and radiocarbon dating which shows that the main concentration of pyrolithic use was approximately 1800–800 BC. This places the use of pyrolithic technology predominantly in Middle Bronze Age (Brindley *et al.* 1989–1990; Ó Drisceoil 1991; Ó Néill 2009). The current study confirms that 838 Chalcolithic and Bronze Age (2500–800 BC) radiocarbon dates have been obtained from 1165 excavated burnt mounds and related pyrolithic burnt stone deposits in Ireland.

Chalcolithic (c.2500–2100 BC)

Some 120 burnt mounds have returned 160 radiocarbon dates dating to the Chalcolithic/early copper-using period *c.*2500–2100 BC (Appendix 1: Figure 10.7). Trough timbers were selected for C14 dating at seven sites, including Hughestown, Co. Roscommon (RM03) (2456–2035 BC); Coonagh West, Co. Limerick (LK61) (2457–2203 BC); Mullamast, Co. Kildare (KD21) (2550–2530 BC) and Ballytarsna, Co. Tipperary (TY57) (2460–2140 BC). An internal trough stake is dated 2460–2140 BC at Kiloteran, Co. Waterford (WD16). No trough timbers are dated to this period using dendrochronology. Some 33 of these sites are supported with additional radiocarbon evidence, confirming a Chalcolithic date. In most cases, the carbon-containing material is derived from the fill of troughs, of which 66 samples were retrieved. Charcoal retrieved from associated burnt stone deposits is dated at 39 sites. Other features dated on Chalcolithic sites include pit fills (30), post-holes (1) and hearths (3). Human bone was dated to the latter half of the Chalcolithic at Belan Co. Kildare (KD34). A radiocarbon date of 2461–2209 BC from a burnt mound at Bockagh, Co. Roscommon (RM20a) may be interpreted as residual in nature and therefore not related, as the timbers are dated to the Late Bronze Age. In a small number of cases, the radiocarbon evidence, relates to a later phase of activity at an earlier site. This was apparent at sites such as Coolderry Co. Tipperary (TY37), Richill, Co. Limerick (LK63) and Clowanstown 2, Co. Meath (MH83). It is apparent that these later phases of use are associated with similar methods of pyrolithic/water-boiling technology. This is a common phenomenon in relation to burnt mounds and continues throughout the Bronze Age (see below).

A small number of artefacts have been recovered from sites dating to this period. This includes material consisting of flaked stone such as flint flakes, scrapers and debitage. Flint blades were recovered from Ballytarsna, Co. Tipperary (TY57), Clonymeath, Co. Meath (MH14), Cooksland, Co. Meath (MH15) and Magheraboy, Co. Sligo (SO17), while a flint barbed and tanged arrowhead, flint flake, chert scraper and axe roughout were recovered from Aghnahunshin, Co. Leitrim (LM10). A chert arrowhead was also recovered from a multi-phased burnt mound site at Moanduff, Co. Carlow (CW14), with the earliest activity on the site dating to the Chalcolithic (2464–2287 BC).

A hollow-based arrowhead was recovered from Roestown, Co. Meath (MH50), along with flint debitage, scrapers and flint flakes. Bone and polished stone beads were also recovered from the site (Cagney and Ginn 2009). No substantial amount of prehistoric pottery has been recovered from sites dating to this period, however a possible sherd of Beaker pottery was recovered from topsoil at Mullamast Co. Kildare (KD21), while unidentified prehistoric pottery was also found in troughs at Prumplestown, Co. Kildare (KD17) and Lisdornan Co. Meath (MH04). Other artefacts recovered from sites dating to this period include possible rubbing stones at Danesfort, Co. Kilkenny (KK52), a honestone at Arbraccan, Co. Meath (MH63), a possible antler pick at Kilbeg, Co. Westmeath (WM35).

Some 83 burnt stone deposits or pyrolithic sites dating to the Chalcolithic are associated with troughs. Approximately 17 of these had linings consisting of wood, stone or a combination of both. Twenty-eight sites contained a trough or troughs with internal cut features such as stake-holes suggesting they may have originally been lined with timbers or wattle work. In the latter case, these would have functioned as uprights for weaving hazel or willow sails for the side walls of the trough. It appears on current evidence that troughs were only lined with such materials during the Chalcolithic. It appears that wattling was only used to line the sides of rectangular and circular/oval troughs, a method that first emerged during this period in Ireland (see Chapter 4). Wood from internal wattle structures have been dated at Lisdornan, Co. Meath (MH04) and Kilotern Co. Waterford (WD16). Plank-lined troughs of this period are dated at Ballytarsna, Co. Tipperary (TY57), Belan, Co. Kildare (KD32), Mullamast, Co. Kildare (KD21) and Hughstown Co. Roscommon (RM03). Stone was used along with timber to line troughs at Attireesh, Co. Mayo (MO26) and Coonagh West, Co. Limerick (LK61).

Overflow channels associated with troughs at Ballyadam, Co. Cork (CO75) and Magheraboy, Co. Sligo (SO17), along with possibly walkways and metalled surfaces at Mullamast Co. Kildare (KD21) and Ballykeoghan, Co. Kilkenny (KK49a), would imply that water inundation at some pyrolithic sites was a concern during the Chalcolithic. This is not surprising given the notable

increase in the use of pyrolithic water-boiling during the Early Bronze Age and the targeting of specific areas prone to waterlogging. Associated trough structures, which are absent in the Neolithic archaeological record, also begin to emerge during the Early Bronze Age with early stake-hole clusters identified at Cherryville, Co. Kildare (KD08), Knockadrina, Co. Kilkenny (KK38) and Addergoole, Co. Laois (LS08). These stake-holes possibly relate to some forms of timber or wattle screens, drying or hanging racks (see Chapter 4).

Early Bronze Age (c.2100–1600 BC)

Approximately 231 burnt mounds have returned 285 radiocarbon dates for this period (Appendix 1: Figure 10.8). Trough timbers have been dated at ten sites, including Monnany, Co. Monaghan (MN02), Kilbeg, Co. Westmeath (WM40) and Clashroe Co. Cork (CO14). Internal trough supports were dated to this period at seven sites and include examples at Fauleens Co. Mayo (MO46), Kilbegly, Co. Roscommon (RM12), Bockagh, Co. Roscommon (RM18) and Raheen, Co. Limerick (LK01). In most cases, the carbon-containing material is derived from the fill of troughs, of which 122 samples were retrieved. Charcoal from the fill of a stake-hole associated with an internal trough support was dated at Deerpark East, Co. Mayo (MO16), while charcoal from associated burnt mound material is dated at 85 sites. Other features were also dated on a number of Chalcolithic sites including pit fills (45), post-holes (8) and hearths (2). Early Bronze Age dates at eight sites suggest the radiocarbon evidence relates to a separate, later phase of pyrolithic activity at an earlier burnt mound site, while later Bronze Age phases were identified at 27 sites. It should be acknowledged, however, that some of these Early Bronze Age dates, particularly those derived from sites with multiple early or later dates, may be intrusive to the site and may not relate to a pyrolithic phase of activity. This may be the case at Ballyellin, Co. Wexford (WX07), Knockaun, Co. Clare (CE08) and Drumminacloghaun, Co. Clare (CE64).

As with other Bronze Age sites, flaked stone assemblages are commonly recovered from Early Bronze Age burnt mounds. Lithics consisting of flint flakes, scrapers and blades have been recovered from Caltragh, Co. Sligo (SO09), Magheraboy, Co. Sligo (SO18), Ask, Co. Wexford (WX05), Ballyellin, Co. Wexford (WX08), Boherard, Co. Laois (LS15b) and Knockaun, Co. Clare (CE08). A hoard of flint pebbles was recovered associated with an Early Bronze Age burnt mound at Fermoy, Co. Cork (CO49c). Less diagnostic finds include hammerstones recovered from Dromthacker, Co. Kerry (KY04b), Boherard, Co. Laois (LS15b) and Macroney Upper, Co. Cork (CO97) while a possible rubbing stone was found during excavations at Caheraphuca, Co. Clare (CE45). More diagnostic, datable material has also been recovered from sites dating to this period. For instance, beaker pottery was been recovered from Ask, Co. Wexford (WX05), Ahanaglogh, Co. Waterford (WD03), Boherard, Co. Laois (LS15b) and Ballyclogh, Co. Wicklow (WW44a). Fragments of a possible food vessel were recovered from Carrickmines Great Co. Dublin (DN15) while an unidentified decorated sherd of prehistoric pottery was found in a burnt mound at Leacarrow, Co. Mayo (MO03). Further, unidentified pottery was recovered from Inchagreenoge, Co. Limerick (LK45) and Lisdornan, Co. Meath (MH04) while fragments of encrusted urn were uncovered during excavation of an Early Bronze Age burnt mound at Clogh, Co. Wexford (WX10). Other artefacts from Early Bronze Age contexts include a possible antler pick at Kilbeg, Co. Westmeath (WM36) and an unusual object interpreted as a possible antler haft at Correagh Co. Westmeath (WM41a; Figure 5.10). A possible stone bead was recovered from a trough at Kilmorebrannagh, Co. Kildare (KD12).

In relation to boiling receptacles, 162 sites dated to the Early Bronze Age are associated with troughs. Circular, wattle-lined examples are particularly common in the archaeological record, a lining method that appeared to be popular during the Early Chalcolithic. It is not unusual to find rectangular plank-lined troughs of this period with associated wattle side walls (Figure 5.9). Preserved wattle-linings were identified at Kilbegly, Co. Roscommon (RM12), Correagh, Co. Westmeath (WM41a), Heathstown, Co. Westmeath (WM14), Balreask, Co. Meath (MH33), and Ballyclough Co. Wicklow (WW44a). Examples of possible wattle-lined examples include those uncovered at Cloghers, Co. Kerry (KY06), Rathbane, Co. Limerick (LK17), Graigueshoneen, Co. Waterford (WD04), Ask, Co. Wexford (WX05) and Ballyadam, Co. Cork (CO75). Rectangular, plank-lined troughs are also common during this period and have been recovered from sites at Monanny, Co. Monaghan (MN02), Bockagh, Co. Roscommon (RM18) and Inchagreenoge, Co. Limerick (LK45). Only one possible stone-lined example has been dated to this period. A charcoal sample taken from the fill of a stone-lined pit at Errew, Co. Leitrim (LM12) is dated 2200–1960 BC.

There are a number of pyrolithic sites dated to this period that may also be associated with a dry pyrolithic technology. Some are situated in areas absent of any immediate water sources, lending further support to the possibility that the pits may have functioned as dry roasting ovens for small-scale cooking episodes. Examples would include pits with associated burnt stone deposits at Coolnastudd, Co. Wexford (WX13), Tinnock Lower, Co. Wexford (WX22), Burrow or Glennanummer, Co. Offaly (OY08b), Annahagh, Co. Monaghan (MN05) and Cloonfane, Co. Mayo (MO66). Sites such as these would imply that the technology was not solely practiced in specific areas of landscape for pyrolithic water-boiling, but functioned in many different ways for a variety of social reasons. They can be compared with some other small scale Chalcolithic and Neolithic examples (see Chapter 8).

Middle Bronze Age (c.1600–1200 BC)

A total of 196 burnt mounds have returned 248 radiocarbon dates for the Middle Bronze Age (Appendix 1: Figure

Figure 5.9: Remains of Early Bronze Age trough at Bockagh, near Ballaghaderreen, Co. Roscommon. Source: IAC Ltd and Transport Infrastructure Ireland.

10.9). Trough timbers were selected for dating at thirteen sites with two sites at Killalough, Co. Cork (CO21) and Tomies East, Co. Kerry (Dunne and Doolin 2001: 22), dated using dendrochronology. Allowing for the possibility of trough timbers being re-used, sites like these can be securely dated to the period as the wood sample comes from a structural feature connected with a pyrolithic/water-boiling technology. Furthermore, 52 of these sites are supported by radiocarbon evidence that confirms a Middle Bronze Age date. In most cases, the carbon-containing material is derived from the fill of troughs, of which 93 samples were retrieved. Charcoal from the fill of a stake-hole associated with an internal trough support is dated at Killeagh Co. Cork (CO99), while charcoal from the burnt mound materials is dated at 65 sites. Other features were also dated on these sites including pit fills of which seven out of 23 were interpreted as wells. Samples from five hearths are dated to the Middle Bronze Age while one possible platform and two trackways are also dated to this period.

Middle Bronze Age dates from nine sites suggest the radiocarbon evidence relates to a separate, later phase of pyrolithic activity at an earlier burnt mound, while later Bronze Age phases were identified at twelve sites. It should be acknowledged however, that some of these Middle Bronze Age dates, particularly those derived from sites with multiple early or later dates, may be intrusive to the site and not related to a pyrolithic phase of activity. This may be the case at Coonagh West, Co. Limerick (LK61), Rathduff Upper, Co. Kilkenny (KK43) and Kellymount 2, Co. Kilkenny (KK56).

A small number of relevant artefacts have been recovered from forty-three sites, however few can be precisely dated to the Middle Bronze Age. A number of sites produced earlier artefacts of Neolithic age, such as at Sheephouse Farm, Co. Meath (MH01), Clonmore North, Co. Tipperary (TY34) and Ballynapark, Co. Wicklow (WW35). A number of personal objects of higher status have been recovered from Middle Bronze Age sites, including amber beads from Fahee South, Co. Clare (CE01) and Straheglin, Co. Cavan (CN10), as well as a gold ring and a tin bead found beneath trough timbers at Killeens, Co. Cork (CO04) and Sonnagh, Co. Mayo (MO52) respectively. The latter is almost pure metallic tin and is highly unusual for Ireland with the only other parallels found at Flag Fen, Norfolk, England, although the examples at Killeens, Co. Cork (CO04), and

another at Rathmore, Co. Wicklow (WW07), had tin cores covered in gold foil. Other personal objects include two polished bone pendants recovered from a pit interpreted as a possible sweatlodge at Burrow or Glennanummer, Co. Offaly (OY08). A palstave was found from an unstratified context at Camlin 1, Co. Tipperary (TY69) while a similar example was recovered from Ballynatona, Millstreet, Co. Cork (Cherry 1990). A possible antler haft was recovered at Correagh, Co. Westmeath (WM41).

As previously mentioned, stone tool assemblages are the most commonly recovered artefact from pyrolithic sites and many found associated Middle Bronze Age burnt mounds can tentatively be dated typologically and/or technologically to the Bronze Age. Twenty-eight sites radiocarbon dated to this period have produced small flaked stone assemblages consisting mostly of flint flakes and possible scrapers. These include finds at Coolroe, Co. Mayo (MO12), Ardan, Co. Offaly (OY05), Caltragh, Co. Sligo (SO06), Ballyellin, Co. Wexford (WX07) and Bennettstown, Co. Meath (MH72). A flint blade was recovered from a Middle Bronze Age burnt mound at Annahagh, Co. Monaghan (MN04), while similar artefacts were retrieved from Rathcash, Co. Kilkenny (KK40) and Williamstown, Co. Westmeath (WM25a). While the occurrence of this material is not necessarily a reliable indication of a Bronze Age date (see Woodman *et al.* 2006), the occurrence of more diagnostic macro tools (e.g. saddle querns, large rubbing stones, some types of hones and spindle whorls, etc.) in other sites is more definitive. Six Middle Bronze Age sites have produced saddle querns or fragments of querns dating to this period such as Buntalloon, Co. Kerry (KY05), Monreagh, Co. Clare (CE59), Rathcash, Co. Kilkenny (KK41a) and Graigueshoneen, Co. Waterford (WD07). Rubbing stones have been recovered from two sites at Moher, Co. Leitrim (LM07), and Ballyquirk, Co. Kilkenny (KK33d). Hone or whetstones are recovered from sites at Bannagagole, Co. Carlow (CW13) and Williamstown or Bawn, Co. Meath (MH71a), while a number of possible hammerstones were retrieved at Shanboe, Co. Laois (LS44), Gortaroe, Co. Mayo (MO29), Graigueshoneen, Co. Waterford (WD07), and Macroney, Upper Co. Cork (CO97). An exceptionally large example was recovered from a site at Garranes, Co. Cork (CO57) on the Beara Peninsula (O'Brien 2012a).

Other domestic finds from Middle Bronze Age burnt mounds include fragments of prehistoric pottery recovered from Furzypark, Co. Galway (GY08) and Clonmore North, Co. Tipperary (TY34). However, only the sherds found at the latter site can be associated with Middle Bronze Age activity, as the fragments from Furzypark may pre-date the use of pyrolithic technology. The pottery was found to be from a bipartite bowl, a vessel more usually associated with funerary sites (Wilkins 2007). Similarly, the excavation of a Middle Bronze Age burnt mound at Graigueshoneen, Co. Waterford (WD07) produced fragments of beaker pottery which were later interpreted as being related to earlier Chalcolithic activity in the area.

An estimated 157 burnt stone deposits are associated with troughs, with 47 of these having linings of wood, stone or a combination of both. At least twenty-three troughs had internal cut features such as stake-holes, suggesting they may have originally been timber-lined, acting as supports for side planks or stone slabs. Two troughs at Coolroe, Co. Mayo (MO12) and Caraun More, Co. Galway (GY17) were lined with hazel wattle-work, a technique usually associated with the Chalcolithic/Early Bronze Age (see above). Forty sites did not produce evidence of troughs, however 15 examples did produce pits that may have functioned as either small boiling pits or some type of roasting ovens. These include examples at Kilbrien Co. Cork (CO51) and Islands Co. Kilkenny (KK25). Limited excavation may account for the absences of troughs at other sites dated to the Middle Bronze Age.

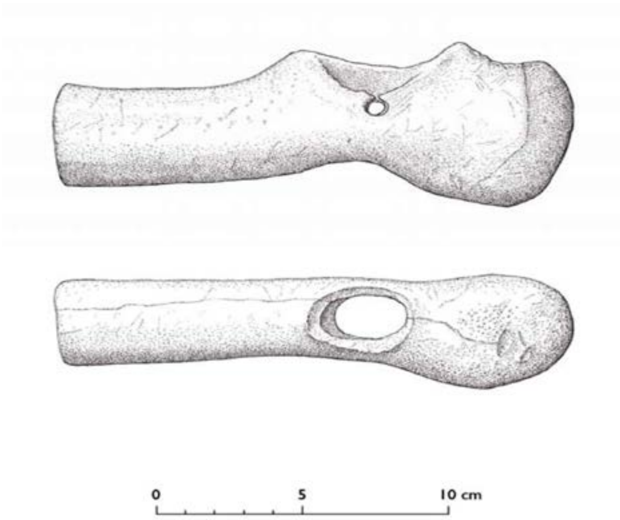

Figure 5.10: Possible antler haft from a burnt mound at Correagh, Co. Westmeath. Source: IAC Ltd.

Significantly, a new form of trough type was used for pyrolithic water-boiling in the Middle Bronze Age (see Chapter 4 for further details). Hollowed-out trees and canoes were used as receptacles for water-boiling at eight sites, with elongated pits at Ballynagarbry, Co. Westmeath (WM02) and Rathduff Upper, Co. Kilkenny (KK43) possibly used to hold such troughs. The vessels at these sites were either re-used elsewhere after water-boiling ceased or did not survive archaeologically. The pit at the latter site was surrounded at the outer edge by a number of small stones possibly used to support the trough once it was placed in the pit. Other *in situ* examples include Killalough, Co. Cork (CO21), Killeens, Co. Cork (CO04) and Caheraphuca, Co. Clare (CE49).

The use of stone in trough linings is also introduced during this period, but does not seem to become widespread until the Late Bronze Age (Figure 5.11). This may have been a gradual process, as a number of stone-lined troughs dating to the Middle Bronze Age have produced additional internal stake-holes or other timber elements possibly used as stone supports. Other stone structures were also introduced, including formal hearths composed of a

C-shaped setting of stones located immediately adjacent to troughs. Out of twenty-three formal hearths dating to this period, ten had surviving stone elements such as Dromnea, Co. Cork (CO13), Ballydowney, Co. Kerry (KY10) and Glencove, Co. Waterford (WD24) (see Chapter 4).

Late Bronze Age (c.1200/1100–800/700 BC)

An estimated 181 burnt mounds are scientifically dated to the Late Bronze Age period (a further 42 sites are dated to Late Bronze Age/ Iron Age transition and are discussed in the following section). Trough timbers were selected for dating at 21 sites and seven of these were dated using dendrochronology (Appendix 1: Figure 10.10). Internal corner post or stakes used to secure trough linings were dated at five sites, bringing a total of 21 burnt mounds securely dated to the Late Bronze Age. In most cases, the carbon-containing material is derived from the fill of troughs, of which 88 samples were retrieved. Charcoal from the fill of internal trough supports is dated at four sites, while burnt mounds and spread deposits are dated at 44 sites. Other features were also dated on a number of Late Bronze Age sites including pit fills of which seven out of 23 were interpreted as wells or cisterns. Six possible structures were dated to the Late Bronze Age, while a timber platform, a trackway and a single hearth were also selected for radiocarbon analysis.

Late Bronze Age dates at nineteen sites suggest the radiocarbon evidence relates to a separate, later phase of pyrolithic activity at an earlier burnt mound. It is apparent that these later phases of use are associated with similar methods of pyrolithic/water-boiling technology. This is a common phenomenon and continues throughout the Bronze Age, with certain troughs being re-used or re-cut in later periods (see below). Certain later dates, however, representing possible Iron Age and Medieval use phases, can be problematic, with the majority unrelated to the use of pyrolithic technology. This is also explored further in a later section.

A small number of artefacts are recorded from Late Bronze Age burnt mounds, though few can be precisely dated to this period. As previously discussed, issues relating to context and association are problematic due to levelling of many sites through agricultural processes in later periods. This has resulted in the dispersal of many artefacts and ecofacts such as animal bone, which are often retrieved from levelled mound material. A number of Neolithic artefacts have been recovered from Late Bronze Age burnt mounds, an issue that was discussed previously. These include a flint plano-convex knife of possible Neolithic date from a site at Cuffsborough, Co. Laois (LS34), and stone axes were recovered at Monreagh, Co. Clare (CE59). These, along with similar objects found at Ballymaclode, Co. Waterford (WD30) were interpreted as residual finds unrelated to the sites, possibly disturbed when they were in use or subsequently abandoned through later ploughing.

Fifty-six sites dating to the Late Bronze Age have produced metal artefacts, a small number of which can be stylistically dated to the period. These include several copper-alloy and bronze pins uncovered at Clogh-East, Co. Limerick (LK39), Greeneenagh, Co. Galway (GY05) and Castleinch, Co. Kilkenny (KK04) (Grogan *et al.* 2007; Jones 2007; Stevens 2005). The latter example has been identified as a copper-alloy swan neckpin of Hallstatt type *c.*600–500 BC (*ibid.*: 2005). A copper-alloy crutch-headed stick-pin was also recovered from Clogh East, Co. Limerick (LK39) from the base of a large pit interpreted as a possible well. Other high-status finds from Late Bronze Age contexts include two gold ornaments recovered from burnt mound deposits at Ballymaclode, Co. Waterford (WD30). The first object was a gold bracelet, while the second consisted of a folded strip of sheet gold, with one end folded back to form a tube. This object can be identified as two fragments of a particular type of British bracelet referred to as a coil-ended bracelet or a re-curved terminal bracelet (Cahill 2009). It is unclear whether the objects were deliberately deposited in the burnt mound due to disturbed nature of the site, however the objects are of interest due to the suggestion that the Great Clare gold hoard of 1845 may have been deposited in a burnt mound close to Mooghaun hillfort in Co. Clare (Condit 1996; Grogan 2005).

A bronze palstave was found at the base of a large pit or well at Ballynakelly, Co. Dublin (DN31), dated to the Middle-to-Late Bronze Age. Pyrolithic water-boiling activity was uncovered adjacent to the pit and charcoal from the fill of a trough was dated to the Late Bronze Age. A socketed axe was found at Camlin 1, Co. Tipperary (TY69) and although the find was recovered from the topsoil, it was later established to be contemporaneous with the radiocarbon evidence. A fragment of a Late Bronze Age socketed axe was found in a similar context at Ballynapark Co. Wicklow (WW35), where the pyrolithic activity was considerably older than the typologically dated object. A bronze flanged axehead with a stopridge was recoved from a depth of 1.22m in a burnt mound at Ballynatona, Co. Cork. Acording to Cherry (1990: 50), it is the only well-stratified find from an unexcavated site.

Forty excavated burnt mounds in Ireland have produced pottery of later Bronze Age date. A small number, such as those from Roscath, Co. Wicklow (WW51), Leacarrow, Co. Mayo (MO03) and Laughanstown, Co. Dublin (DN16) can be identified as being typical Late Bronze Age coarse ware (Grogan and Roche 2009; Gosling *et al.* 2007). Another assemblage of flat-based coarse ware was recovered from a burnt mound at Coarhamore, Co. Kerry (KY03) (Sheehan 1990). Although the material could not be dated, similar pottery from a nearby hut site is securely dated to the Late Bronze Age (Hayden 1994). Similarly, at Strandsfield, Co. Wexford (WX03), pottery recovered from a possible windbreak structure and a natural clay layer adjacent to the trough were interpreted as being of possible Late Bronze Age origin in the absence of secure radiocarbon dating from the site (McCarthy 2002). The

pottery recovered from Tinryland, Co. Carlow (CW07), Ballybar Lower, Co. Carlow (CW10) and Knockaun, Co. Clare (CE08) could not be identified as they survived in poor condition, while in other cases only a limited amount of information is available for the site.

Other domestic finds from Late Bronze Age burnt mounds include a number of spindle whorls, stone discs and a number of saddle querns. The seven spindle whorls recovered from excavated sites have all been found in later Bronze Age contexts, apart from one example from Raheenagurren West, Co. Wexford (WX19), which came from a possible Iron Age context. An example at Coarhamore, Co. Kerry (KY03), was initially identified as early medieval in origin (Sheehan 1990), however this is now recognised as prehistoric in date and can be compared with a growing number of Late Bronze Age examples (R. O'Brien 2010). Further examples were recovered from a burnt mound at Holdenstown, Co. Kilkenny (KK37) and Carrigatogher Harding, Co. Tipperary (TY52a), while a decorated example was found in the fill of a trough-like pit in the interior of a Late Bronze house at Kilemly, Co. Tipperary (R.O'Brien 2009). Two granite stone discs were recovered from a site at Dunkitt, Co. Kilkenny (KK15), which may have been spindle whorl blanks. One was recovered from the fill of a large pit while the other was found at a hearth site which was dated to the Iron Age. Although from different periods they were almost identical in size and form (Gregory 2003). Similar discs were recovered from Dananbeg 1, Co. Kilkenny (KK53a), Ballykeoghan, Co. Kilkenny (KK49b), Carranstown, Co. Meath (MH30) and from well-known sites of Ballyvourney (CO02) and Drombeg in Co. Cork (CO07).

Another diagnostically Bronze Age artefact is the saddle quern, with 18 examples recovered from burnt mounds in Ireland, seven coming from Late Bronze Age contexts. A saddle quern, complete with a rubbing stone or pestle was retrieved from a primary trough deposit at Ballyduff East, Co Waterford (WD22a). The find was interpreted as a possible deliberate deposit as it was unlikely to have been left behind and no damage was noted (Hegarty *et al.* 2011). Similar finds were recovered from troughs at Charlesland, Co. Wicklow (WW23) and Inchirourke, Co. Tipperary (TY63a), while another quern was recovered from a large pit interpreted as a structure at Ballykeoghan, Co. Kilkenny (KK49b) (Laidlaw 2008). A saddle quern was re-used for the lining of a drainage channel at Drombeg Co. Cork (CO07), with another example re-used in the lining of a stone trough at Butlerstown, Co. Cork (CO18). The other examples recovered from Late Bronze Age burnt mound were found in topsoil or adjacent to sites, therefore their association with the site is unclear.

Lithic material remains the most common artefact recovered from these sites. Flint and chert were retrieved from 21 Late Bronze Age burnt mounds, however few diagnostic pieces are recorded and most of this material was found in levelled burnt mound material. Ten scrapers were identified from this assemblage consisting of chert and flint examples. Chert scrapers were retrieved from Grallagh, Co. Mayo (MO44), Ballyclough North, Co.

Figure 5.11: Remains of stone-lined trough at Currinah, Co. Roscommon. Source: IAC Ltd and Transport Infrastructure Ireland.

Wicklow (WW44) and Attireesh, Co. Mayo (MO23). The latter is a hollow-based example and may date to the Neolithic period (Gillespie 2001). A flint thumbnail scraper was found in the fill of a Late Bronze Age plank-lined trough at Monnany, Co. Monahan (MN03), while a burnt chert end scraper was retrieved from a pit at Ballybar Lower, Co. Carlow (CW10). The remainder of the lithic material found at Late Bronze Age burnt mounds is undiagnostic, consisting of small flaked material that could have a broad date range.

Approximately 182 sites contained troughs, 51 of which had linings of wood, stone or a combination of both. Twenty two of these were selected for dating analysis. Thirty-eight troughs had internal cut features such as stake-holes suggesting they may have originally been timber-lined. In each of these cases, four stake-holes were noted, one in each corner. Where timber linings survive, these stakes served as supports for the internal structure. Eleven sites did not produce evidence of troughs, however limited excavation may account for their absence. Thirty of these troughs are lined with split planks consisting of oak, alder and elm, while eight troughs are lined with roundwoods of various sizes consisting of ash, alder, hazel and oak. Examples at Dunlo, Co. Galway (GY32) and Killoran, Co. Tipperary (TY04) contained wicker or wattle-lined troughs, a type usually found at Early Bronze Age burnt mounds. Further analysis of trough morphology is discussed in Chapter 4. A combination of wickerwork and roundwood was used in the construction of a trough at Brockagh 4, Co. Roscommon (RM20). The fill of two stone-lined troughs at Drombeg, Co. Cork (CO7) and Currinah, Co. Roscommon (RM09) were dated to the Late Bronze Age, a trough type which is predominantly found in later prehistory. A hollowed-out tree trunk used as a trough was uncovered at Caheraphuca, Co. Clare (CE49), with charcoal from the trough cut dated to the Late Bronze Age. This may relate to a second phase of activity, as all hollow-out troughs found at burnt mounds appear to be consistently Middle Bronze Age in date (see Chapter 4). Possible clay linings were revealed at four burnt mounds, while no internal linings were evident at twenty four sites.

All troughs found with internal linings are rectangular in shape, with the exception of an example at Dunlo, Co. Galway (GY32). Rectangular troughs are the most common type found at Late Bronze Age burnt mounds, with 128 examples identified. Thirteen troughs were oval in shape, while six were circular and two identified as sub-square. On average these troughs measured 2.2m by 1.5m with a depth of 0.39, with only one example from Ballymountain, Co. Kilkenny (KK16), greater than 3m in length. Possible internal compartments dividing the internal space within the trough were revealed at Currinah, Co. Roscommon (RM11), Curraheen 5, Co. Cork (CO37) and Cahiracon, Co. Clare (CE22). The latter was seemingly reused in the Early Iron Age and a deposit of unburnt stone placed in one half of the trough. This shortened the trough and created a platform at one end (Grogan *et al.* 2007).

Seven examples of trough lining had deposits of moss packed between the timber elements, acting as a possible filtering system, to allow cleaner water to fill the trough. The presence of gullies or water channels connected to lined troughs such as Cahiracon, Co. Clare (CE21), Gaurraundorragh, Co. Kerry (KY14), Gracedieu West, Co. Waterford (WD11), Baloo, Co. Down (DW10) and Johnstown, Co. Carlow (CW03a) further attests to the requirement of fresh water after each use. Nine further sites dating to this period had evidence for possible water-channels connected to pits, wells or troughs.

5.6 THE IRON AGE TRADITION

A recent project reappraising the Irish Iron Age reported 17 burnt mounds/spreads dating to the period 800 BC–400 AD (Becker et al. 2008; Dowling and McCarthy 2011). A number of these, however, cannot be described as burnt mound (water-boiling locations) and a number of errors are noted. For instance, the burnt mound at Ballyadam, Co. Cork is interpreted as Iron Age. The date, in fact relates to a series of pits unrelated to the Early Bronze Age burnt mound (Cleary and Hawkes 2013). The current study has identified that 81 Iron Age radiocarbon dates have been obtained from seventy burnt stone deposits in Ireland.

Fifty-five of these dated contexts fall within the early part of that period, between *c.*800–400 BC (Figure 5.12). Nineteen samples have been dated to the developed Iron Age, *c.*400 BC–AD 200 while seven are dated to the latter half of the Iron Age *c.*AD 200–400. Thirty-three of these Iron Age dates relate to a separate phases of activity at an earlier burnt mound location. The study reveals that open-air pyrolithic water-boiling continued to be practiced in Ireland until the late Bronze Age. The tradition then begins to rapidly die out during the Middle to Late Iron Age, possibly being replaced by other forms of social feasting.

Early Iron Age (c.800–400 BC)

A total of 55 dated contexts fall within the Late Bronze Age/Early Iron Age period. Twenty-three of these samples derive from wood charcoal from the fill of troughs, while seven dates are associated with burnt mound material. Some 14 radiocarbon dates were obtained from the fills of other excavated features such as pits or stake-holes. A further six wooden corner pegs or stakes associated with internal timber trough linings are radiocarbon dated to this period, while wood interpreted as possible lining material was dated from the base of a trough at Catstown, Co. Kilkenny (KK01) and Fermoy, Co. Cork (CO48). A fragment of animal bone was selected for radiocarbon dating from the primary fill of a pit interpreted as a possible well at Curragh, Co. Laois (LS35a) and Mearsparkfarm, Co. Westmeath (WM55), with cattle bone dated from the fill of troughs at Ballynamony, Co. Kildare (KD31) and Mearsparkfarm, Co. Westmeath (WM56). No plank linings from troughs are dated by dendrochronology to this period.

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
CE22	Cahiracon	Clare	Trough fill (Charcoal)	803–525 BC	A
CO48	Fermoy	Cork	Trough (Timber)	820–410 BC	A
CO45	Ballynahina	Cork	Trough fill (Charcoal)	900–370 BC	B
LS24a	Clonadacasey	Laois	Trough fill (Charcoal)	840–750 BC	B
KK30a	Glashare	Kilkenny	Trough fill (Charcoal)	830–590 BC	B
NC	Glenbeha 1	Tipperary	Burnt mound (Charcoal)	820–750 BC	B
CE63	Drumminacloghaun	Clare	Trough fill (Charcoal)	817–551 BC	B
CE50	Caheraphuca	Clare	Pit fill (Charcoal)	813–554 BC	C
KK52	Danesfort 2	Kilkenny	Post-Hole fill (Charcoal)	806–595 BC	C
LS27	Coolfin	Laois	Trough fill (Charcoal)	810–560 BC	B
RM13	Ardagawna	Roscommon	Stake-Hole fill (Charcoal)	802–541 BC	C
MO62	Casheldluff IV	Mayo	Trough fill (Charcoal)	793–553 BC	B
MH61	Derver 4	Meath	Burnt mound (Charcoal)	795–421 BC	B
LS22b	Cappaloughlin	Laois	Pit fill (Charcoal)	700–530 BC	C
CE21	Cahiracon	Clare	Trough peg	800–540 BC	A
MO59	Fauleens II	Mayo	Trough post	786–545 BC	A
WX01	Dungeer	Wexford	Trough fill (Charcoal)	800–530 BC	B
WM56	Mearsparkfarm	Westmeath	Trough fill (Bone)	792–419 BC	B
WM55	Mearsparkfarm	Westmeath	Well fill (Bone)	773–382 BC	C
LK63	Brackbaun	Limerick	Trough fill (Charcoal)	789–425 BC	B
LM12	Errew	Leitrim	Burnt mound (Charcoal)	790–500 BC	B
MO58	Fauleens I	Mayo	Trough post	774–521 BC	A
KK47	Stonecarthy west I	Kilkenny	Trough fill (Charcoal)	771–539 BC	B
CO63	Scartbarry	Cork	Stake-Hole fill (Charcoal)	789-419 BC	B
GY05	Greeneenagh	Galway	Trough fill (Charcoal)	791–419 BC	B
KD31	Ballynamony	Kildare	Trough fill (Bone)	780–410 BC	B
KD16	Ballyburn Lower	Kildare	Pit fill (hazelnut shell)	778–416 BC	C
KK48	Knocktopher	Kilkenny	Trough fill (Charcoal)	776–507 BC	B
WD23	Carriganard	Waterford	Pit fill (Charcoal)	791–410 BC	C
CO71	Ballinglanna north	Cork	Trough fill (Charcoal)	766–524 BC	B
CE50	Caheraphuca	Clare	Deposit (Charcoal)	766–420 BC	C
KK37	Holdenstown 4	Kilkenny	Trough fill (Charcoal)	765–420 BC	B
MO47	Sonnagh I	Mayo	Trough fill (Charcoal)	761–418 BC	B
CO07	Drombeg	Cork	Trough fill (Charcoal)	770–400 BC	B
TY63a	Inchirourke	Tipperary	Trough fill (Charcoal)	760–410 BC	B
GY15	Caraun More	Galway	Burnt mound (Charcoal)	760–410 BC	B
TY52a	Carrigatogher Harding	Tipperary	Deposit (Charcoal)	749–412 BC	C
KK01	Catstown	Kilkenny	Pit fill (Charcoal)	766–401 BC	C
CW06	Busherstown	Carlow	Well fill (charcoal	751–406 BC	C
KK57	Kellymount 3	Kilkenny	Trough fill (Charcoal)	751–409 BC	B
LS18	Bushfield	Laois	Well fill (charcoal)	750–390 BC	C
RM13	Ardagawna	Roscommon	Burnt mound (Charcoal)	748–406 BC	B
RM13	Ardagawna	Roscommon	Trough fill (Charcoal)	746–406 BC	B
WX06	Ask	Wexford	Trough fill (Charcoal)	755–408 BC	B

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
GY22	Moyveela	Galway	Trough fill (Charcoal)	731–406 BC	B
CE36	Shannakea	Clare	Trough fill (Charcoal)	761–393 BC	B
MX16	Moneycross Upper	Wexford	Trough stake	750–396 BC	A
KK52	Danesfort 2	Kilkenny	Pit fill (Charcoal)	744–407BC	B
CE61	Sranagalloon 3	Clare	Burnt mound (Charcoal)	706–400 BC	B
WX16	Moneycross Upper	Wexford	Trough stake	748–391 BC	A
WX16	Moneycross Upper	Wexford	Trough stake	748–388 BC	A
RM15a	Taduff East 1	Roscommon	Trough fill (Charcoal)	702–395 BC	B
LS35a	Curragh	Laois	Well fill (charcoal	740–380 BC	B
KK06	Parksgrove	Kilkenny	Furnace pit (Charcoal)	757–261 BC	D
GY32	Dunlo	Galway	Burnt mound (Charcoal)	507–386 BC	B
KD19	Burtenhall Demesne	Kildare	Trough fill (Charcoal)	509–261 BC	B
WM56	Hallsfarm I	Westmeath	Pit fill (Charoal)	511–207 BC	D
MH74	Johnstown I	Meath	Well fill (Bone)	401–206 BC	D
KY09	Coolgarriff	Kerry	Unknown	410–160 BC	D
CO58	Fermoy Wood	Cork	Trough stake	384–203 BC	A
WX19	Raheenagurren West	Wexford	Pit fill (Charcoal)	380–200 BC	D
MH25	Rath	Meath	Hearth (Charcoal)	370–110 BC	B
KD33	Moone	Kildare	Trough fill (Charcoal)	360–110 BC	B
KD33	Moone	Kildare	Trough fill (Charcoal)	360–90 BC	B
CE30	Cragbrien	Clare	Pit fill (Charcoal)	352–101 BC	C
KK41b	Rathcash	Kilkenny	Well fill (Hazelnut shell)	344–55 BC	D
KD33	Moone	Kildare	Well fill (Charcoal)	360 BC–10AD	B
CE30	Cragbrien	Clare	Pit fill (Charcoal)	338–92 BC	C
KK19	Rathpatrick	Kilkenny	Trough fill (Charcoal)	344 BC–57 AD	B
CO36	Curraheen 4	Cork	Pit fill (Charcoal)	185 BC–85 AD	D
TY63a	Inchirourke	Tipperary	Trough fill (Charcoal)	110–70 AD	C
MH62	Derver 5	Meath	Pit fill (Charcoal)	43 BC–AD 126	D
KD33	Moone	Kildare	Pit fill (Charcoal)	40 BC–130 AD	B
MH56	Castlekeeran 3	Meath	Burnt spread (Charcoal)	41 BC– AD 129 BC	D
WM48	Ballikilmore	Westmeath	Charcoal spread	AD 1–125	D
LK32	Ballymackeamore	Limerick	Pit fill (Charcoal)	AD 62–212	D
KK55	Kellymount 2	Kilkenny	Trough fill (Charcoal)	AD 236–380	D
RM04	Cloonagownagh	Roscommon	Unknown	AD 134–432	D
KD20	Booleybeg	Kildare	Pit fill (Charcoal)	AD 260–560	D
LK47	Inchinclare	Limerick	Pit fill (Charcoal)	AD 389–534	E
LK19	Crabbsland	Limerick	Pit fill (Charcoal)	AD 265–615	E

Figure 5.12: Late Bronze Age/Iron Age radiocarbon dates from burnt stone deposits in Ireland (Radiocarbon dates calibrated at 95.4% confidence.).

Thirteen of these sites contained troughs lined with either wood or stone, while five sites had troughs that may have originally been lined, as indicated by the presence of internal stake-holes. These stake-holes would presumably have contained supports for an internal timber lining. All of these troughs were well defined and were sub-rectangular to rectangular in plan, measuring on average 2.3m by 1.39m with a depth of 0.37m. Three examples had linings of split and whole roundwood, comprised of a mixture of alder, hazel, ash and occasional oak. Five troughs were built using split planks consisting only of oak (CO48; CO63; MO59; CE21; CE22). Three of the trough fills were contained within stone linings. These were observed

as Cashelduff, Co. Mayo (MO62), Shannakea Beg, Co. Clare (CE36) and Drombeg, Co. Cork (CO07).

A trough with the remains of a possible stone and timber lining was excavated at Ballinglanna North, Co. Cork (CO71). This pit was connected to a water channel and a well located immediately downslope (Tierney 2010). Similar drainage channels were revealed at Carrigatogher Harding Site 3, Co. Tipperary (TY52a). The sites of Caraun More, Co. Galway (GY15), Errew, Co. Leitrim (LM12d) and Parksgrove, Co. Kilkenny (KK06) were revealed as mounds or spreads of heat-shattered stone and did not overlay any troughs. Although these features may survive outside the area of excavation, their interpretation as burnt mounds remains questionable.

Middle Iron Age (c.400 BC–AD 200)

Thirteen sites displaying deposits of burnt stone have produced 19 dated contexts within the Middle Iron Age period in Ireland *c.*400 BC–AD 200. Seven samples derive from wood charcoal from the fill of pits, while five were recovered from features interpreted as troughs. The remainder of the radiocarbon evidence was retrieved from burnt stone deposits (two sites) hearth features (one site) and Wells (three sites). A human femur from the fill of a trough at Moone, Co. Kildare (KD33) is dated 360–110 BC, while an internal trough stake (oak) was selected for radiocarbon dating at Fermoy Wood, Co. Cork (CO58). A hearth at Rath, Co. Meath (MH26) dated 370–110 BC was associated with a larger structure interpreted as a sweatlodge.

The majority of the radiocarbon evidence was obtained from pit features with associated burnt stone deposits and fills consisting of heat-shattered stone and charcoal. Two pits identified at Rathcash, Co. Kilkenny (KK41b) and Moone, Co. Kildare (KD33) may have served as wells due to their relative depths and the constant inflow of water at their bases. A similar date was obtained from a re-cut well pit at Johnstown 1, Co. Meath (MH74) implying that these dates may have no association with the use of pyrolithic technology and could simply be a result of a maintained water-source in later periods. Similar Iron Age dates were retrieved from wells at Kellymount 2, Co. Kilkenny (KK57) and Mearsparkfarm, Co. Westmeath (WM55), and so a degree of caution should be applied in assuming an association with pyrolithic water-boiling.

Samples of wood or charcoal dated to the Middle Iron Age is recorded from five trough fills, with an internal stake being selected for dating at one other trough at Fermoy Wood, Co. Cork (CO58). These troughs were sub-rectangular to rectangular in shape with the exception of a circular example at Moone, Co. Kildare (KD33) measuring 1.1m in diameter. These troughs had average dimensions of 2.55m by 1.89m by 0.38m and only Fermoy Wood, Co. Cork (CO58) and Burtonhall Demesne, Co. Kildare (KD19) contained evidence to suggest they may have been timber-lined. The trough at the latter site was not fully exposed but did contain several internal stake-holes suggesting some form of timber lining (Stephenson 2008). The earliest of these trough fills was at Hallsfarm, Co. Westmeath (WM56) dated to 509–261 BC, while an example from Inchirourke, Co. Tipperary (TY63a) returned a date of 110 BC–AD 70.

Evidence of pyrolithic activity during the later part of the Middle Iron Age is problematic. The author has failed to establish the context of radiocarbon evidence at Coolgarrif, Co. Kerry (KY09), while at Cragbrien, Co. Clare (CE30) the sample was derived from a cremation pit adjacent to the burnt spread. The single radiocarbon determination from an adjacent pit at Raheenagureen, Co. Wexford (WX19) cannot reliably date the pyrolithic activity at the site. The remaining sites at Rath, Co. Meath (MH25), Curraheen 4, Co. Cork (CO36), Inchirourke, Co. Tipperary (TY63a), Castlekeeran 3, Co. Meath (MH56) and Dever 5, Co. Meath (MH62) represent later activity at burnt mounds, which is supported by earlier Bronze Age dates from more secure contexts in those sites. While possibly connected to a re-establishment of a pyrolithic process, they must be viewed with a certain degree of caution as other factors may account for the dating evidence.

Late Iron Age (c.AD 200–500)

Seven of the dated contexts fall within this period. Two of these samples were retrieved from the fills of troughs, while three were obtained from pits. It is unknown whether the dated context from Cloongownagh, Co. Roscommon (RM04) was recovered from the trough fill or the burnt mound material. Some of the other dated contexts within this period should be viewed with a degree of caution as many result from secondary activity possibly unrelated to the use of pyrolithic technology.

The Late Iron Age date obtained from Crabbsland, Co. Limerick (LK19), was the result of later activity at an Early Bronze Age burnt mound (Coyne 2001). This small feature was cut into a clay mantle that overlay the mound. It was interpreted as the remains of a possible roasting pit, however the use of pyrolithic technology is questionable as no burnt stone was found in the fill. No other features of Late Iron Age date were identified on the site, therefore it cannot be interpreted as a burnt mound. A similar date was obtained from a pit at Inchinclare, Co. Limerick (LK47) (Grogan *et al.* 2007: 285). A single pit was excavated which contained occasional burnt stone and eight fragments of unidentified cremated bone. An adjacent spread consisted of charcoal and oxidised clay representing some sort of burning event. It is possible that this feature is a cremation pit and that the presence of fire-cracked stone may have been the result of hearth material being backfilled into the pit and not associated with a pyrolithic technology.

A burnt mound at Boleybeg, Co. Kildare (KD20) is dated AD 260–560 (Dennehy 2009). The site was situated on a natural platform in an otherwise wet environment. It consisted of a burnt mound and several cut features

including two troughs. The dated context came from a shallow pit filled with large fragments of heat-affected stone. It was interpreted as a roasting pit and on the southern limits of the burnt spread. The date must be taken with some degree of caution, however, as it is the only radiocarbon sample from a site that contained numerous cut features, including two troughs sealed by the burnt mound.

Four sites dated to the Late Iron Age produced troughs, however only one of these has been radiocarbon dated. The primary fill of a trough at Ballymackeamore, Co. Limerick (LK32) is dated AD 62–212 (Grogan *et al.* 2007: 248). The site also produced an Early Bronze Age date reportedly from an adjacent spread of burnt stone, however there is some confusion as to the true context of these samples. The full extent of the site was not revealed during excavation and due to the ambiguous nature of the radiocarbon samples, the Iron Age phase of activity must be treated with caution.

Similar to the situation identified at Rathcash, Co. Kilkenny (KK41b), Johnstown Co. Meath (MH74) and Mearsparkfarm, Co. Westmeath (WM55), the sample from Kellymount 2, Co. Kilkenny (KK56), dating to AD 236–38 was retrieved from a well or water-hole. This possibly indicates that such important water sources remained open and used for a period after pyrolithic activity ceased at the site (Coughlan 2010; see Chapter 4). This is supported by a number of wells dating to the medieval and modern periods at burnt mounds such as Clashnevin, Co. Tipperary and Ballyglass West, Co. Galway (GY31). Therefore, it is likely that the Late Iron Age activity at Kellymount 2, Co. Kilkenny (KK56) was in fact associated with a water-source that was originally constructed for use in an Early Bronze Age phase of pyrolithic activity. As a result, there is little evidence to suggest that pyrolithic water-boiling continued to be used during the Late Iron Age in Ireland, with a somewhat similar picture in Britain (Anthony 2003; Topping 2011; Ó Néill 2009). This is explored further in Chapter 8.

5.7 A MEDIEVAL TRADITION?

It has long been suggested that early literary accounts of burnt mounds and pyrolithic processes may in fact relate to preserved folk memories of a site type long since gone out of use (Ó Drisceóil 1990: 163; Mallory 1992: 129; Danaher 2007: 37). This view is now supported by the archaeological evidence. Ó Néill's analysis of 93 dated contexts in Ireland demonstrated that these sites were not used after the developed Iron Age for a period of *c.*750 years before re-emerging again during the Early Medieval period. Of the sites examined by him, only 5% were dated to the medieval period, and these included the sites dated by artefact associations (Ó Néill 2005: 83; 2009: 40). It is now apparent however that the burnt mound/*fulacht fia* (water-boiling) process did not continue into the historic period (Hawkes 2012).

Figure 5.13. Burnt spread dated to the Early Medieval Period at Cloonvane IV, Co. Mayo. Source: Agnes Kerrigan, Mayo County Council and Transport Infrastructure Ireland.

It is largely because of the literary sources that many commentators in the modern era have accepted that the burnt mound tradition of open-air pyrolithic water-boiling continued into the medieval period (Edwards 1990: 66). Over the last decade Ireland has seen a major increase in burnt mound discoveries, due primarily to investments in our road and gas networks. It is now possible to review recent projects to examine how many sites date to the historic period. A critical assessment of each dated context was undertaken to assess the reliability of the dating evidence in relation to pyrolithic processes. The study shows that 48 excavated burnt mounds in Ireland have produced 60 radiocarbon results or other dating information for the medieval period (Figure 5.14). A critical review of these radiocarbon dates was undertaken using a grading system outlined by Mook and Waterbolk in 1985 (Hawkes 2012; see below). This was also used elsewhere in relation to early prehistoric dating evidence (Hawkes 2014). This is based on the degree of certainty of the dated sample and its association with pyrolithic activity. The analysis reveals that out of 60 medieval radiocarbon dates, none can be connected with the type of pyrolithic/water-boiling process known from burnt mounds. Forty-one of the dated contexts have clearly no association with the use of pyrolithic technology, while five sites cannot definitively be related to the process (Figure 5.13). Although some of these sites bear a superficial resemblance to earlier burnt mounds, in that they also produced burnt stone, none have troughs to indicate some connection with water-boiling.

The radiocarbon-dated stake at Kiloteran 7, Co. Waterford (WD15), which was revealed adjacent to a possible hollowed-out tree trunk, may, in fact relate to the nearby vertical watermill at Kiloteran 9 dated to the early seventh century (Eogan and Shee-Twohig 2011: 13). The Middle Bronze Age evidence (Beta-209764) from the burnt mound material is more likely to date the pyrolithic activity at the site. The single radiocarbon determinations from Killalane 2, Co. Tipperary (TY49b), and Bushfield/Maghernaskeagh 5, Co. Laois (LS17), must be viewed with caution as other factors may account for the radiocarbon evidence such as contamination or intrusive material. The other radiocarbon evidence at sites such as Doughiska,

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
NC	Ballycorick	Clare	Pit (charcoal)	AD 434–644	E
WD15	Kiloteran 7	Waterford	Stake (wood)	AD 432–600	D
CN16	Putiaghan Upper 2	Cavan	Pit (charcoal)	AD 432–581	E
NC	Tullahedy	Tipperary	Pit (charcoal)	AD 428–555	E
			Charcoal deposit	AD 765–894	E
LS44	Shanboe 5	Laois	Pit (charcoal)	AD 695–947	E
CO84	Curraheen	Cork	Hearth (charcoal)	AD 690–886	E
DN01	Ballyman	Dublin	Spread (bone)	AD 683–887	D
			Spread (bone)	AD 830–1151	D
TY	Killoran 23	Tipperary	Pit (charcoal)	AD 656–870	D
CW14	Moanduff 1	Carlow	Pit (charcoal)	AD 650–765	D
MO68	Cloonfane VI	Mayo	Spread (charcoal)	AD 780–991	D
LK33	Ballymackeamore	Limerick	Pit (charcoal)	AD 778–980	E
LS29	Coolfin 4	Laois	Pit (charcoal)	AD 778–980	E
WM42	Kilgaroan	Westmeath	Pit (charcoal)	AD 898–1019	E
				AD 897–1025	D
MO63	Cloonaghboy III	Mayo	Spread (charcoal)	AD 894–1148	D
LH22	Littlemill 2	Louth	Pit (charcoal)	AD 893–1225	D
LK19	Crabbsland	Limerick	Furnace (charcoal)	AD 893–1206	E
			Furnace (charcoal)	AD 829–1155	E
LM02	Kildorragh	Leitrim	Unknown	AD 892–1153	D
WX16	Moneycross Upper	Wexford	Hearth (charcoal)	AD 892–1115	E
TY49b	Killalane 2	Tipperary	Pit (charcoal)	AD 891–1013	D
LM10	Aghnahunshin 1	Leitrim	Pit (charcoal)	AD 890–1030	E
LS17	Bushfield 5 or Maghernaskeagh	Laois	Pit (charcoal)	AD 890–1020	C
NC	Fofannybane	Down	Spread (charcoal)	AD 883–1151	E
MH61	Derver 4	Meath	Pit (charcoal)	AD 877–1024	D
MO42	Skiddernagh I	Mayo	Pit (charcoal)	AD 996–1220	E
WM57	Hallsfarm II	Westmeath	Pit (charcoal)	AD 992–1161	D
				AD 1018–1155	D
TY	Clashnevin	Tipperary	Well (charcoal)	AD 982–1040	D
MO55	Sonnagh VIII	Mayo	Pit (charcoal)	AD 977–1153	D
MH83	Clowanstown 2	Meath	Pit (charcoal)	AD 937–1213	D
TY19	Knockaunkennedy	Tipperary	Pit (charcoal)	AD 1055–1261	E
				AD 1168–1263	E
MH72	Bennetstown	Meath	Pit (charcoal)	AD 1046–1267	E
			Pit (charcoal)	AD 1034–1220	E
LK44	Finniterstown	Limerick	Pit (charcoal)	AD 1035–1207	E
TY46	Annaholty 4	Tipperary	Spread (charcoal)	AD 1034–1155	E
MH33c	Balreask 3	Meath	Spread (charcoal)	AD 1033–1207	E
			Spread (charcoal)	AD 1043–1251	E
GY14c	Doughiska	Galway	Pit and spread	AD 1022–1155	D
				AD 1024–1182	D

Cat. No	Site Name	County	Context dated	Dating Evidence	Reliability
TY50a	Carrigatogher (Harding)	Tipperary	Hearth (Charcoal)	AD 1018–1154	D
RM04	Cloongownagh 2	Roscommon	Pit (Charcoal)	AD 1010–1170	D
NC	Kilmurry North 2	Wicklow	Pit (Charcoal)	AD 1000–1240	E
				AD 900–1160	E
LM06	Georgia	Leitrim	Spread (Charcoal)	AD 1190–1280	E
KK01	Catstown	Kilkenny	Pit (Charcoal)	AD 1159–1389	E
WM56	Hallsfarm I	Westmeath	Pit (Charcoal)	AD 1289–1410	D
			Pit (Charcoal)	AD 890–988	D
TY23	Richmond (Site J)	Tipperary	Pit and spread	AD 1270–1415	E
				AD 1309–1448	E
MO67	Cloonfane IV	Mayo	Spread (Charcoal)	AD 1257–1394	D
TY47	Annaholty 7	Tipperary	Pit (Charcoal)	AD 1219–1275	E
CE57	Derrygarrif I	Clare	Pit (Charcoal)	AD 1321–1432	D
NC	Gneevebeg	Westmeath	Pit (Charcoal)	AD 1429–1625	E
LK34	Ballymackeamore	Limerick	Spread (Charcoal)	AD 1422–1631	E
NC	Ballymount Great	Dublin	Pit (Charcoal)	AD 1405–1632	E
KY03	Coarhamore	Kerry	Trough	Spindle Whorl	-
NC	Peter Street	Waterford	Pit	Med Pottery	-

Figure 5.14. Medieval radiocarbon dates and other dating evidence from burnt stone deposits in Ireland (Radiocarbon dates calibrated at 95.4% confidence). NC= not catalogued.

Co. Galway (GY14d) and Littlemill 2, Co. Louth (LH22) may be associated with a pyrolithic/water boiling process, however the insubstantial nature of these pits makes it unlikely that they were used as receptacles for heating liquids. While possibly connected to the use of hot-stone technology, albeit on a very small scale, the shallowness of the pits suggests a function possibly associated with roasting, baking or steaming. Thoms (2008: 445) has written extensively on the use of hot rocks in western North America, where prolonged cooking is required to hydrolyse inulin-rich roots adequately, as well as to detoxify plant foods, thereby rendering them more readily digestible and nutritious. Similar practices have also been recorded in New Guinea (Steensberg 1980) (see Chapter 3 and Chapter 6 for further discussion).

The majority of sites with early medieval radiocarbon dates have clearly no association with a pyrolithic/water-boiling process. These dated contexts are either intrusive elements to the site or represent activity in a site of medieval date unrelated to pyrolithic technology, possibly associated with iron working process or charcoal production (see Chapter 8). Examples include a number of sites recorded as very small, isolated burnt stone spreads such as Cloonfane IV and VI, Co. Mayo (MO67 and MO68), Cloonaghboy, Co. Mayo (MO63), Ballymackeamore, Co. Limerick (LK34) and Georgia Co. Leitrim. None of these deposits are associated with any cut features relating to boiling activities, therefore it is difficult to assess their significance (see Chapter 6 and Chapter 8) The spread of mound material at Skiddernagh, Co. Mayo (MO42) was the only site that exhibited any prehistoric features and it is likely that the radiocarbon sample was an intrusive element to the site given the level of disturbance noted in the mound material (Murphy 2008). Similar, intrusive material may have been dated at Fofannybane, Co. Down (not fully excavated), Ballyman, Co. Dublin (DN01) and Richmond, Co. Tipperary (TY23). The other spread deposits are too insubstantial to be interpreted as a burnt mound water-boiling site. One possibility is that they represent single episode events such as small fire spots related to tree and scrub clearance where stones were burnt as a result. The cultural context of pyrolithic activity in later periods is explored further in Chapter 8.

5.8 Site Histories: Phasing and Internal Chronology

As mentioned previously, the seemingly undifferentiated nature of mound deposits generated by the use of pyrolithic technology means that detailed stratigraphic analysis is not often possible. Where evidence exists for multiple phases of use on a site, this is seen principally in the form of numerous pits and through the replacement, re-cutting and re-lining of troughs. The true life-cycle of a burnt mound, however, can be difficult to establish. Obviously, scientific dating methods provide some answers, especially where multiple contexts are dated, but it is difficult to determine

whether or not sites were 'persistent places' in the landscape (Schlanger 1992). Similar to prehistoric habitation sites, the act of settling at a locale may have involved reference to the previous use of that place. As Bradley (1991) observed, people live their lives in relation to the past and they understand their world by referring to tradition. A water-boiling area may have played a similar role, as an appropriate setting to invoke the past and tradition in the ordering of a living society.

As outlined by Gibson (2013: 99), it is not difficult to understand how 'monumental' sites in the landscape continued to be relevant in the lives of later inhabitants. In fact, studies relating to memory and landscape have emphasised the continued significance of large ritual monuments of place over time. Smaller or less 'visible' features may also have been bound up in such practices over long periods, including prehistoric burnt mounds. The evidence indicates that, rather than becoming static and quickly forgotten, the significance of these places was sometimes retained, remembered and redefined by later groups. In relation to settlement patterns, 'the distribution of archaeological materials across a landscape is almost always a product of many years and even generations of use' (Dewer and McBride 1992: 229). This can be extended to include burnt mound deposits, which may not necessarily reflect an articulation of a typical seasonal round with permanent landscape features, but rather many years of the establishment and abandonment of residential occupations on a landscape, some of whose features altered over time in response to cycles of previous use. As such, it is important to acknowledge that the evidence of earlier pyrolithic activity must have influenced in some way that which followed it. Burnt mounds may have been layered with meaning through multiple episodes of earlier activity, each of which left its own distinctive physical imprint.

From the radiocarbon record of Irish burnt mounds, it is possible to see the re-use of certain sites as a powerful material reminder of identify, important for the construction and reproduction of social memory, investing groups with a sense of past. To this end, certain aspects of commemoration may have been important at some burnt mounds with the deposition of objects seen to either maintain social memories, ritual traditions or to underline ancestral connections to reinforce their physical and social place in the landscape (see Chapter 6).

The archaeological record of burnt mound 're-use'

To discuss aspects of site re-use, it is necessary to consider terminology and how this represents the archaeological record. For instance, what do we mean by the term 're-use' when it may be obvious that many burnt mounds in Ireland had long histories of use. Re-use at burnt mounds is best demonstrated at those sites where multi-context radiocarbon sampling is applied, establishing a detailed site chronology of occupation and abandonment. Unfortunately, the number of sites dated in such a manner is relatively few, with sampling methods not always capturing the entire history of a site. The general approach in many excavations has been to obtain a single radiocarbon date for what was believed to be a short lived activity. This view is often based, correctly or not, on the size of the burnt mound.

While the radiocarbon evidence may indicate that a particular pyrolithic site was 'returned' to after an interval of disuse, it is difficult to differentiate burnt mound re-use after shorter periods of inactivity such as a week, month, year, decade or century. All we can say is that some sites were used for 'prolonged periods' while others were 're-used' after phases of abandonment. While the former may reflect aspects of continuity where a burnt mound could have been used seasonally, the latter signifies periods of 're-occupation' after short or long episodes of inactivity.

While it can be difficult in the absence of radiocarbon dates to distinguish between sites used for prolonged periods and those which were 're-used', in some cases this can be demonstrated by other means. Where evidence exists for multiple phases of use on a site, it is seen principally in the form of (a) burnt mound stratification, (b) troughs and other pits that have been replaced, re-cut or re-lined, and (c) burnt mound clusters that exhibit prolonged inhabitation of specific areas.

The following section briefly explores how each of these episodes of re-use manifests in the archaeological record, while a later section examines different scenarios of re-use giving site examples from across Ireland.

Burnt mound stratification

A burnt mound is probably the most obvious means of establishing the overall use-history of a pyrolithic site. A mound of burnt stone may have multiple 'lifecycles' but these are not always recognisable, particularly if later disturbance has destroyed the necessary evidence. Attempts have been made to record burnt mounds using the single context recording system to build up a detailed stratigraphic picture of different phases of use; for example, at Inchaquire, Co. Limerick (KD22), and Doughiska, Co. Galway (GY01) (Richardson 2009; McKinstry 2010). While variations in the mound material are common, these cannot be readily linked to dumps of material. Factors such as the arbitrary nature of the waste deposition, the weathering and leaching of exposed material and natural silt build-up around the stones mean that individual tip lines are often difficult to identify during excavation (Richardson 2009: 17). As such, mound material is often regarded as a single, uniform deposit (Figure 5.15). As mentioned previously, this has led to uncertainty in the way in which single radiocarbon dates from mounds should be interpreted (Ó Néill 2009). These provide snapshots in time of mound activity and do not capture the continuum of site use.

Several new directions for research have been identified in recent years. The homogeneity of the burnt mound deposit

Figure 5.15. Burnt mound at Errarooey More, Co. Donegal (RMP DG025-007). The mound is exposed as a single deposit of burnt stone in a matrix of charcoal-rich sediment. Source: Alan Hawkes

at a site in the Norfolk Fens of East Anglia was such that divisions between individual burning and dumping episodes were not possible. Soil micromorphology demonstrated episodic build-up of burnt material, indicative of repeated visits rather than sustained occupation (Crowson 2004: 34). The succession of cut features and the breaks observed in the mound formation demonstrated that the site was probably revisited a number of times, more likely through seasonal activity and renewal rather than sporadic use over an extended period (*ibid*.: 37). This excavation strategy, along with the adoption of soil micromorphology, has yet to be undertaken in an Irish context, but it is one which could be useful where distinct dump layers are indistinguishable. Such analysis could be accompanied by a programme of fine-resolution radiocarbon dating of charcoal fuel residues to investigate the time-scale over which a burnt mound accumulated.

Opportunities for total excavation and detailed sampling provided by some developer-funded excavations in Ireland have allowed detailed histories and biographies of some burnt mounds to be established (Figure 5.16). This, along with their wider landscape context, permits a more in-depth understanding of how these sites developed over time. Some of these contextual approaches are supported by detailed radiocarbon dating, which helps distinguish between the different spatial and temporal deposits. For example, a particular well-preserved mound at Cahiracalla Beg, Co. Clare (CE38), exhibited seven separate depositions of fired debris (Bermingham *et al.* 2012: 31–35). Radiocarbon dating established that the mound began to form during the Chalcolithic and continued in use until the Late Bronze Age. (Figure 5.17) The charcoal derived from short-lived tree species and therefore the radiocarbon determinations are reasonably accurate of the different periods of deposition in the make-up of the mound. At Caherweelder 5, Co. Galway (GY25), a series of separate, but similar deposits consisting of heat-shattered stone and charcoal were identified, suggesting repeated and prolonged use of the site. The radiocarbon dates from the site support this, as they range from the Early to Middle Bronze Age (Delaney and Tierney 2011: 128). At Glen, Clare Island, Co. Mayo (MO02), a burnt mound composed of a complex series of burnt material, represents at least four distinct phases of accumulation (Gosling *et al*. 2007: 78). At Ahanaglogh, Co. Waterford (WD02), twenty-seven separate deposits were recorded in the excavated portion of the mound (Johnson *et al*. 2008: 72).

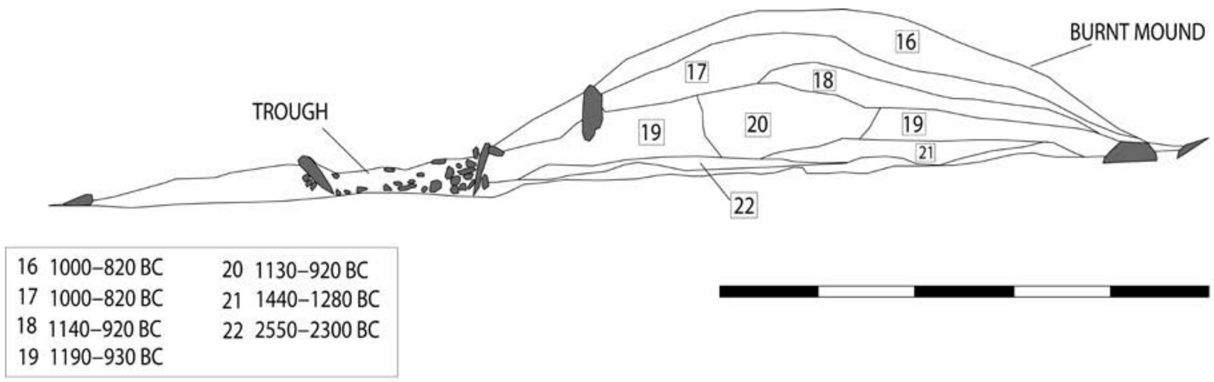

Figure 5.16. Burnt mound at Cahiracalla Beg, Co. Clare showing different phases of use through mound stratification. Source: Adapted from Bermingham *et al.* 2013.

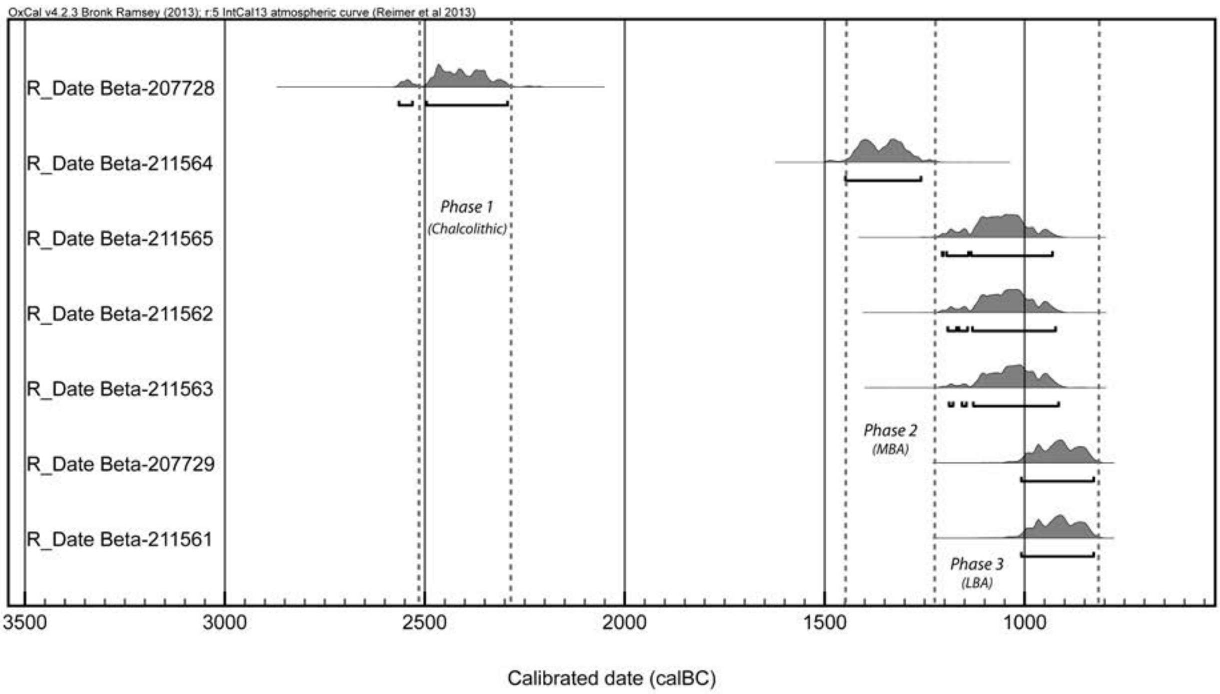

Figure 5.17. Calibration Chart indicating different use phases at Cahiracalla Beg, Co. Clare (Oxcal 4.2.3).

The Cahircalla Beg mound is significant in that, it had a relatively unusual stratigraphic sequence of deposits that provides an absolute chronology for the site. The excavations of burnt mounds at Bearnafunshin, Co. Clare (CE17), Caltragh, Co. Sligo (CO06), Kilmessan, Co. Meath (MH35), Bracetown 1, Co. Meath (MH43), and Brackbaun, Co. Limerick (LK62) reveal different use phases separated by flooding events from adjacent rivers (Grogan *et al.* 2007: 181; Halpin 2005; Tobin 2010; Clarke 2008; McQuade *et al.* 2009: 117). Excavation also demonstrated that these sites were returned to and reused after different episodes of flooding.

Another example comes from the River Tolka, Co. Meath, where a number of sites excavated along the M3 motorway susceptible to flooding could not have been in constant use. These sites were probably used on a seasonally basis.

Later features cut into burnt mounds also indicate episodes of re-use. For example, a number of deliberately laid timbers found on top of mound deposits have been interpreted as possible 'platforms' for activities carried out at those sites. In some cases it is more likely that these represent the remains of truncated troughs where only the base of the feature survives. This is further supported by the identification of supporting stakes placed at the corners of 'platforms' at Killulla, Co. Clare (CE05), Killescragh, Co. Galway (GY18), Sonnagh, Co. Mayo (MO47), and Ballyclogh North, Co. Wicklow (WW43). These are common in Late Bronze Age troughs and were used to support timber side walls.

It is apparent that these features are latter additions to the site associated with a period of re-use as they are placed on earlier burnt mound deposits. For instance, at Sonnagh, Co. Mayo (MO47), the platform was stratigraphically later

than the adjacent trough is it lay on a 0.3m-thick layer of mound material (Gillespie and Kerrigan 2010: 67). At Mullamast, Co. Kildare (KD21), radiocarbon dating has shown that the 'platform' was 250 years later than the dates returned from the burnt mound material and timber trough (Clark 2010). A similar situation was confirmed by radiocarbon dating at Islands, Co. Kilkenny (see below; Hardy and Green 2009).

Trough re-cutting and re-lining

The re-use or continued use of pyrolithic locations is also evident at sites where earlier troughs were re-cut and re-lined, or where a new trough replaces an earlier example. Troughs of different types and sizes are also superimposed on one another (Figure 5.18). As with the changes from timber to stone, this development could be emphasised by destroying the older trough before pyrolithic water-boiling re-commenced at the site. The pattern is most obvious in those cases where successive troughs show no resemblance to one another such as at Killeens, Co. Cork (CO04), Gortaroe, Co. Mayo (MO28) and Lisdornan, Co. Meath (MH04) (O'Kelly 1954; Gillespie 2001; Russell 2001). While some re-cuttings may have been a way of adhering to tradition and maintaining links to the past, choosing to break with traditional practice may also have involved an explicit position on the relationship between the present and the past (Bradley 1993). The builders of these troughs had the potential to remember them in different ways, drawing upon those aspects which seemed most appropriate at that point in time. This was not 'faulty memory' as observed by Holfmann (2013: 49) but 'a process in which the past was actively used to negotiate the present. In other words, memory work was part of the narrative of peoples lives'.

In other cases, where conditions are conducive to preservation, the same timber-lined trough had a long history of use, and was returned to in later periods and modified. This was the case at Cahiracon, Co Clare (CE21), Moneycross Upper, Co. Wexford (WX16), Killoran, Co. Tipperary (TY02), and Perssepark, Co. Galway (GY03), sites where a number of re-linings had taken place Grogan *et al.* 2007: 92; 185; 189 ; Stevens 2010; Cross May *et al.* 2005: 245; Grogan 2007: 230). There is also evidence of more radical transformations when later troughs take on a more durable form than their predecessors. An interesting example is where timber-built troughs were replaced in stone. Stone-lined troughs with internal stake-holes may be multi-phased with the latter evidence reflecting an earlier timber trough. This may be evidence of an essential continuity, but there are cases in which radiocarbon evidence suggests an interval of disuse between the decay of the timber uprights and the creation of later stone setting.

Figure 5.18. Timber trough overlying earlier example at Ballyglass, Co. Sligo. Source: Dominic Delaney

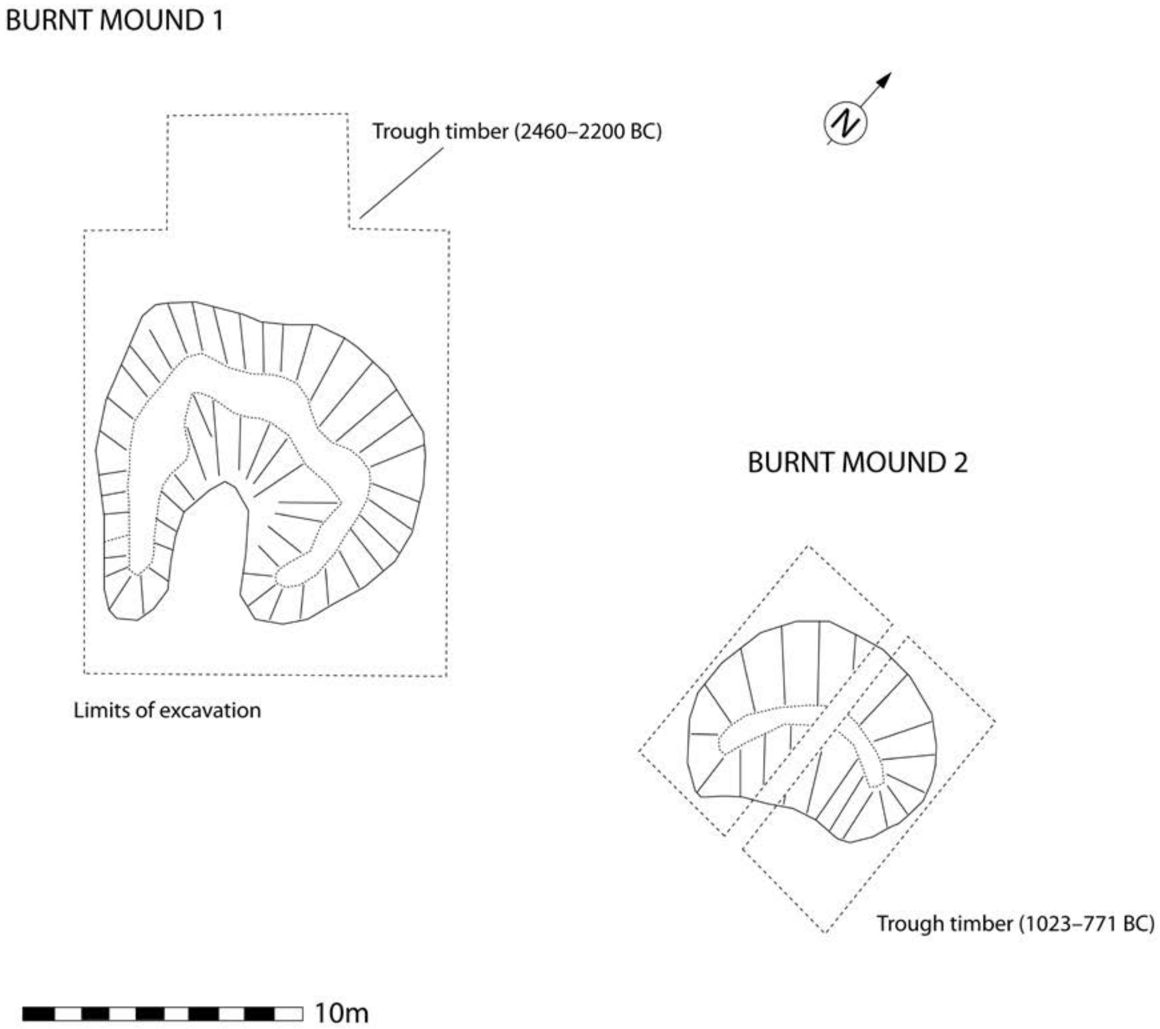

Figure 5.19. Two adjacent burnt mounds created 1,400 years apart at Ballyclogh, Co. Cork. Source: adapted from Lehane 1988.

Where conditions are not conducive to the preservation of organic remains, the re-use of previous troughs may be evident from the re-cutting of pits. A certain degree of caution, however, must be applied in such cases. This may be no more than an over-cut of the original trough pit when the trough was constructed, or if the trough was unlined at the base, the ground level may have reduced when the trough was emptied prior to re-use (Cleary and Hawkes 2013: 11). That said, at a number of sites, such as Lissava, Co. Tipperary (TY29), Gransha, Co. Derry (DY02) and Anthronan, Co. Meath (MH38), the evidence seems to indicate that the site was temporarily abandoned before a new trough was constructed in a possible deliberate attempt to redefine the earlier example (McQuade *et al.* 2009: 112; Chapple 2008: 22−59; McGowen and Fallon 2010). In some cases, the dimension of an earlier trough was adhered to, while in other examples the original pit was widened or shortened depending on user requirements.

In other examples, the original trough cut is avoided, but extended just far enough to take in the cut of the older pit, resulting in the identification of sequential troughs. There may have been some order to an arrangement that was carefully contrived so that a newly built trough cut across earlier examples. These practices may suggest a concern with social continuity and cohesion, and with creating temporal and spatial links between troughs. Such links, as discussed by Robinson in relation to Bronze Age structures, could have acted as 'solid metaphors or 'memory traps' that created lineages of inhabitation activated through material traces and memories of previous generations' (Robinson 2013: 153). Whether or not site sequence can be correctly determined it seems to have been important that troughs built in different (but not necessarily successive) phases should make reference to the positions of the older troughs. Such evidence is obviously tenuous as the latter may have been used concurrently or re-location may have been a result of rising water-levels. These relationships may also be completely coincidental. That being said, the associations are repeated so often that they may be significant and worth exploration. It is possible that the position of older troughs were known even when their visible mounds may have vanished.

The question remains as to how the exact location of these troughs was known after long periods of abandonment. There is no archaeological evidence to suggest that troughs were marked above ground in any way, though in some

instances slabs of stone-lined examples may have been visible. Single stake-holes cutting the base of some unlined troughs may have also served this purpose, however this is unproven. As mentioned earlier, the archaeological evidence does not support the impression that burnt stone was randomly deposited. More than merely being an effect of disposal, it may be that deposits were deliberately built up in crescentic formation to mark the location of a trough during periods of inactivity. As troughs are mostly located between the 'arms' of the mound, this may explain how earlier troughs were re-located and recut after periods of abandonment. This may support the theory that the re-cutting of earlier trough pits was not coincidental in most cases.

Burnt mound clusters

Burnt mound clusters are another indicator of site re-use or more likely 'prolonged' use of an area for pyrolithic processes. They often occur in significant clusters with groups of up to six or more recorded, often within a few metres of each other (Power 2000; Waddell 2000; Grogan 2005). While such clustering possibly indicates the focus of individual communities within a wider landscape of social organisation, little is known of their chronological sequence. Recent road archaeology projects have provided interesting results with regard to the temporal sequence of such groupings. This suggests that all these pyrolithic sites were not in contemporaneous use, and that the appearance of these mounds on the landscape was a slow process over a prolonged period of time. One striking feature is the way burnt mounds seem to be prolific in certain locations. This may be illustrated at Curraheen 5, Co. Cork (CO36) where a burnt mound of Chalcolithic date occurred in the same field as two Late Bronze Age examples. This was also the case at Borris, Co. Tipperary (TY61), and Coonagh West. Co. Limerick (LK60), where significant periods of inactivity separate closely spaced burnt mounds. These sites support the findings of two excavated burnt mounds at Ballyclogh near Fermoy, Co. Cork (CO11) in the 1980s, which yielded a date range of 2460–2200 BC for the timber of one trough, while that from an adjacent mound is dated 1023–771 BC (Lehane 1988; Figure 5.19). Even allowing for a significant 'old wood effect', this suggests an interval of possibly 1,400 years between the use of two pyrolithic sites at the same location. In this way, a single burnt mound may provide the focus for a whole series of mounds in later periods. Often these sites are only slightly different from one another, yet once established they also underwent a complex sequence of refurbishment and modification.

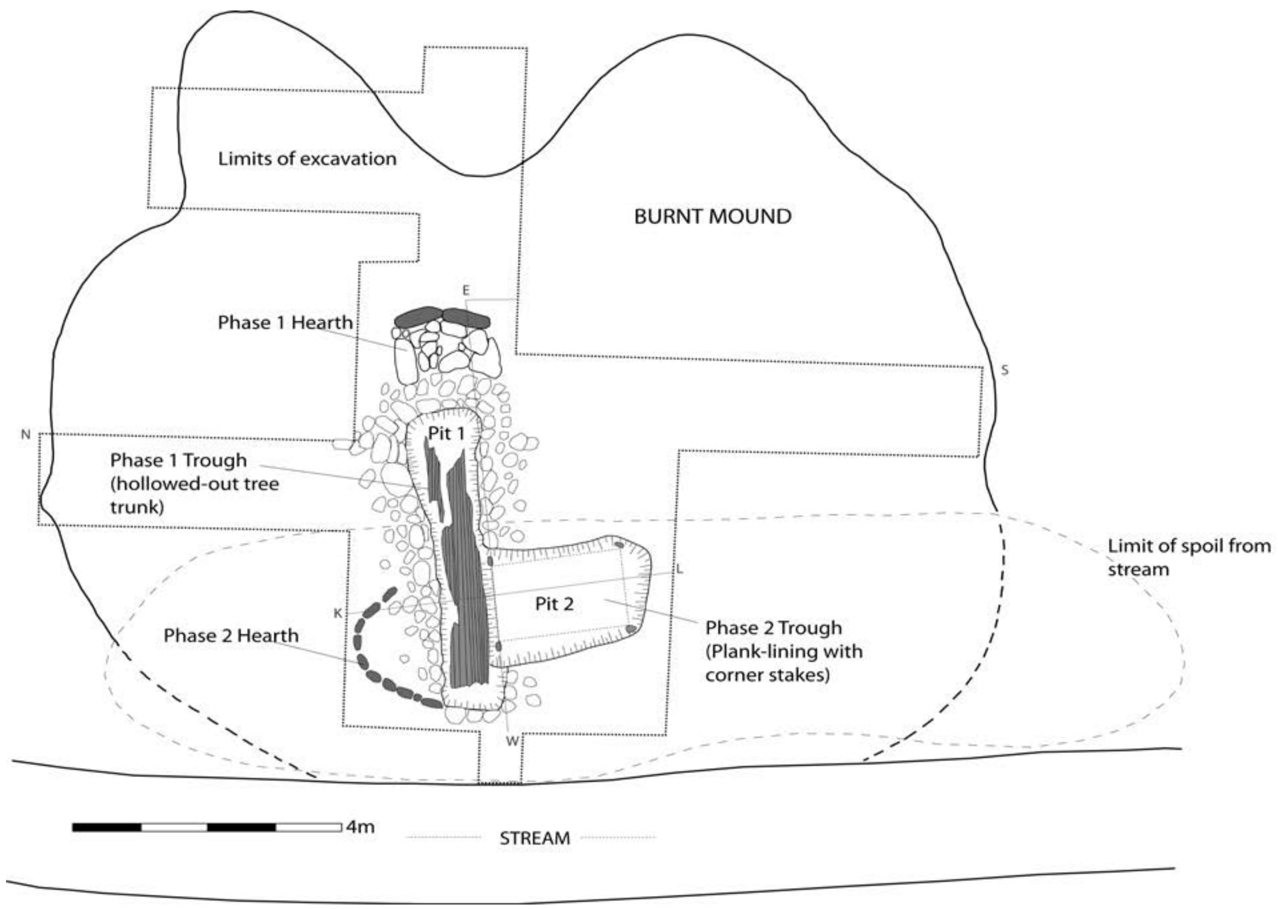

FIGURE 5.20. BURNT MOUND AND SEPARATE TROUGH PHASES AT KILLEENS 2, CO. CORK. SOURCE: ADAPTED FROM O'KELLY 1954.

The implied shift in focus of activity along a particular stretch of river/stream is also intriguing. Such marginal shifts in location are unlikely to be a result of settlement relocation due to their close proximity. Perhaps local environmental factors such as changes in natural drainage, or changes in land use connected to farming hold the key to understanding these apparent shifts in burnt mound location. The function of each site may also have differed in some way as to make an area of ground nearby more suited for the particular activity at hand (Anthony 2003). The location of some burnt mounds on seasonally flooded margins has prompted others to suggest that pyrolithic sites were used seasonally (O'Kelly 1954; Feehan 1991; Grogan 2005). Excavation in recent years has certainly attested to this being the case where silt deposits within the burnt mound matrix indicate flooding events (Schweitzer 2008; Murphy 2008; Hackett 2009; Tobin 2009). In addition, troughs cut at different elevations within a site could be indicative of use at alternate times depending on the level of the water table. An example here is the site of Ballyadam, Co. Cork (CO75), where several troughs were cut at different elevations close to a seasonal pond (Cleary and Hawkes 2013). It is, however, difficult to know how site hydrology has changed (if at all) over the millennia. Certain sites, for instance, show evidence of being systematically moved upslope, possibly as a result of rising water. This seems to have been the case at Gortaroe, Co Mayo (MO29), where a new phase of pyrolithic activity began at a higher elevation as lake levels rose (Gillespie 2001). Seasonal use of burnt mounds would help to partly explain the frequent clustering of several sites in one locality.

While the above examples illustrate how re-use is represented in the archaeological record, it is possible to explore different scenarios of re-use based on a number of well-dated burnt mound locations.

5.9 SCENARIOS OF RE-USE

It is evident that some sites were returned to after periods of inactivity, however, without multi-context sampling for radiocarbon dating, it is difficult to establish a chronology for the overall sequence. While this has been successfully demonstrated at some sites where structural timbers are scientifically dated, for many it is only possible to establish a relative sequence of burnt mound trough use. That said, at least four scenarios of re-use can be identified from the current archaeological record. These include (1) continuous use of burnt mound locations over long periods, (2) episodes of re-use after short intervals, (3) re-use after longer intervals and (4) where there is evidence of a subsequent change of use.

(1) Prolonged use

Prolonged use of burnt mounds is evident from those sites where large mounds of burnt stone are found and where they have been particularly well dated. The general sequence of events observable at these sites is the digging of a pit or pits that functioned as troughs, followed by the build-up of heat-shattered stones and the residues of fires. The one feature all larger extant mounds have in common, apart from their proximity, is that in general there is only one trough present. On this basis it appears that some sites may have been used for one purpose only. This one trough per mound scenario appears to be the case in areas where tight clusters of sites have been excavated such as at Rathmore, Co. Wicklow (WW07), Killeens, Co. Cork (CO04), Errew, Co. Leitrim (LM12), Ballyclogh Co. Cork (CO11), and Caheraphuca Co. Clare (CE45) (McLoughlin 2001; O'Kelly 1954; Péterváry, T. 2007; Lehane 1988; Coughlan 2010). It has also been witnessed at Cahiracalla Beg, Co. Clare (CE38), and Caherweelder, Co. Galway (GY25), where substantial mounds are associated with a single trough located centrally between the arms of the mound (Bermingham *et al.* 2012; Tierney and Delaney 2011). While limited excavation may account for this phenomenon at some excavated sites, more extensive investigations suggests this may have been a true occurrence.

Excavations at Dunlo, Co. Galway (GY32), revealed a substantial burnt mound overlying a large oval trough that was wattle-lined. The mound was composed of several layers of dumped material and measured 21.5m by 18.6m with an overall thickness of 0.8m. The size of the mound is suggestive of prolonged pyrolithic water-boiling at the site. Occasional lenses of peat and clay were visible in the sections over and above the mound layers, which suggested that there were periods when the entire site or parts thereof were not in use, allowing natural peat to form (O'Driscoll 2010). Radiocarbon dates for charcoal samples date the main mound to 1259–1000 BC, while the basal fill of the trough is dated 1112–901 BC. This indicates that the use of the site extended from the Middle Bronze Age to the Late Bronze Age. Following the intensive use of this burnt mound, it is likely that the adjacent site came into use. Charcoal from that mound is dated 507–386 BC, placing the site in the later Bronze Age/Early Iron Age.

The Dunlo site can be compared to Killeens, Co. Cork (CO04; Figure 5.20), where three large burnt mounds were associated with single troughs suggestive of continuous and prolonged use of the area for pyrolithic water-boiling (O'Kelly 1954). At one particular mound, the remains of a rectangular, plank-lined, trough replaced an earlier trough composed of a hollowed-out log with an adjacent formal hearth. A timber sample from the hollowed-out log is dated 1611–1453 BC placing this phase of activity in the Middle Bronze Age (Brindley *et al*. 1989-1990). After a period of time this large trough was replaced by a smaller rectangular pit placed at right angles to the first. This was lined with planks supported with corner stakes, a common lining method during the Middle/Late Bronze Age in Ireland (Hawkes 2015). The secondary trough was associated with a new formal hearth, defined by an arc of small boulders opening to the shorter side of the pit. Interestingly, the timber remains of the earlier trough were not fully removed before the new trough was built.

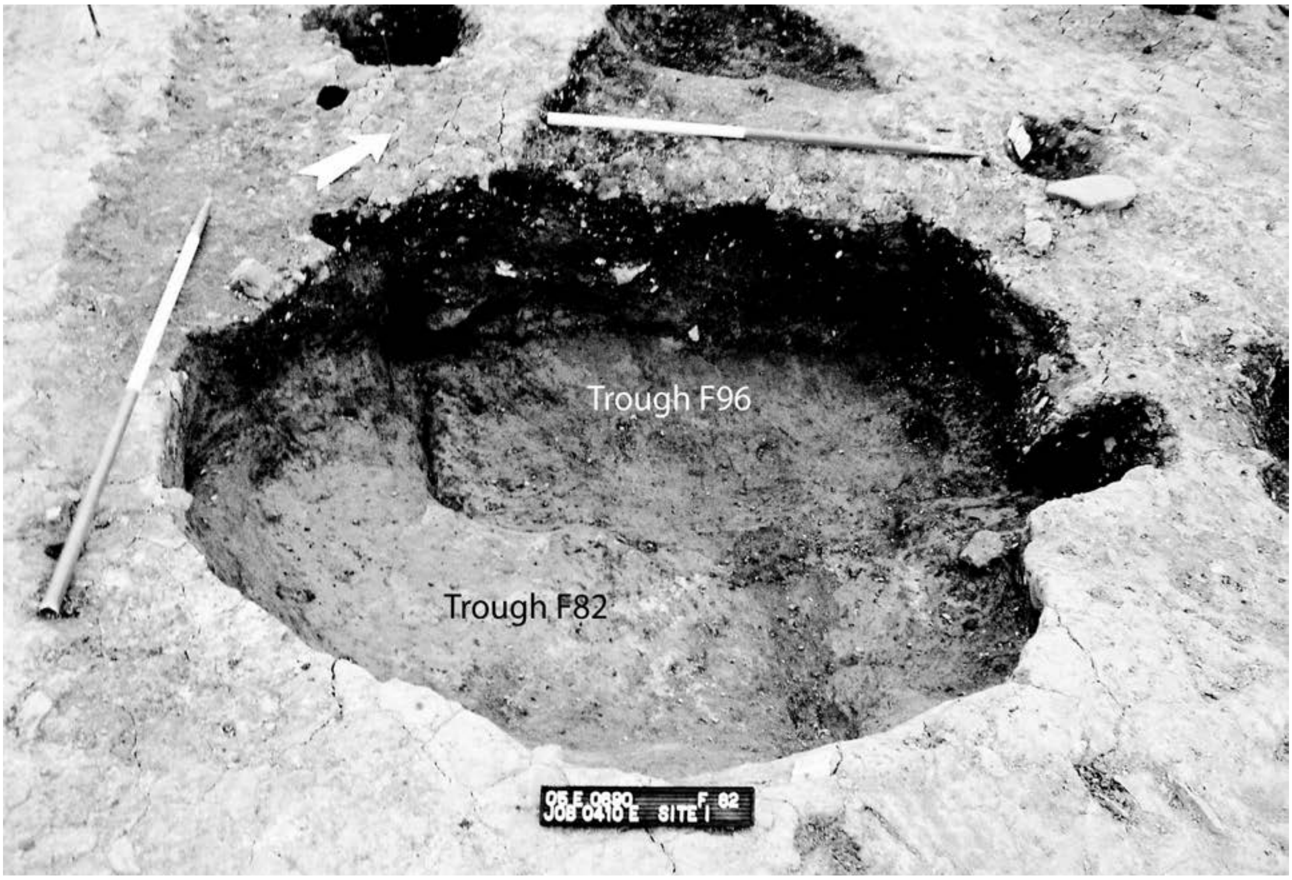

Figure 5.21. Two trough phases at Athronan 1, Co. Meath. Source: Laurence McGowen for CRDS Ltd.

Other pyrolithic sites are much more complex and exhibit evidence of prolonged use involving numerous troughs and pits. For example, at Magheraboy, Co. Sligo (SO17), three troughs associated with a single phase of site use were positioned close together in a north-east/south-west direction. A narrow band of subsoil separated each of the troughs, suggesting that the presence of a trough was known when a new one was dug (*ibid*.: 29). Several troughs are recorded at Fermoy 5, Co. Cork (CO48), where their superimposition suggests the continuous use of the site over a long period (Hanley and Hurley 2013). Similar sequences of troughs are recorded at Leahy's, Co. Limerick (LK52), Cuffsborough, Co. Laois (LS33), Kilbeg 6, Co. Westmeath (WM34), Rathcash, Co. Kilkenny (KK40) and Greenhills, Co. Tipperary (TY67) (Taylor and Jones 2003; Murphy 2008; Lyne 2009; Coughlan and Bailey 2011; Kiely 2011). It is possible however, that some of these troughs and ancillary features were not in use at the same time, and may have developed during periods of episodic use.

At Ballyglass West, Co. Galway (GY31), the excavation of a large burnt mound revealed a number of archaeological features, with the mound itself containing up to 16 different deposits of fired debris associated with water-boiling. Eight potential troughs were identified below the burnt mound, one of which appeared to be stone lined, and others had internal and external stake-holes (Delaney and Tierney 2011: 134). Dates were obtained from hazel charcoal fragments from four deposits. These include Early/Middle Bronze Age dates of 1687−1532 BC from a pit or trench cut into the upper layers of the burnt mound and 1740−1618 BC for an ashy deposit within the mound. A Middle Bronze Age date of 1411−1270 BC was derived from a similar ashy deposit in the sides of a stone-lined trough while a Late Bronze Age date of 1125−978 BC was retrieved from a hazel sample from another trough.

The site can be compared with Seeoge 2, Co. Westmeath (WM21), where a substantial burnt mound overlay several associated features close to the edge of a natural pond. These include at least two and possibly up to four troughs, a probable well or pit, various other pits of unknown function and a substantial rectangular structure (Lyne 2009). Given its size, this mound may represent repeated use of the troughs over a long period, perhaps several generations. The two definite troughs were located at different elevations in the site and were used at alternate times depending on the level of the water table. With regard to the dating of the site, a sample of *pomoideae* charcoal from a posthole is dated 901–816 BC, while a sample of blackthorn charcoal from the fill of a trough is dated 764–416 BC. There is no overlap in these date ranges, neither is the difference between them very great. Seeoge 2 can therefore be seen as a late Bronze Age/Iron Age site, perhaps with a lifespan of up to a few centuries.

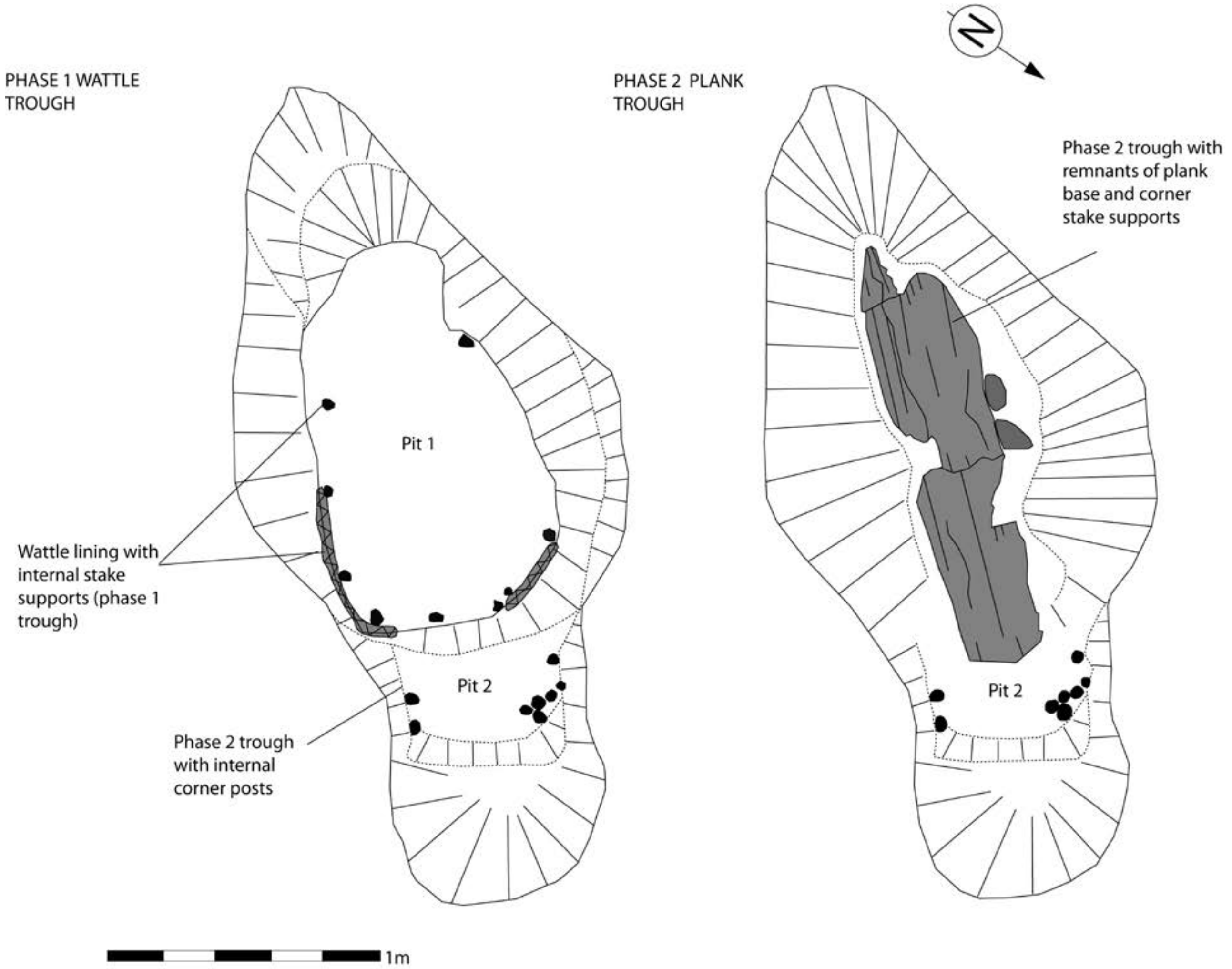

Figure 5.22. Two trough phases at Lisdornan 3, Co. Mayo. Source: adapted from Russell 2001.

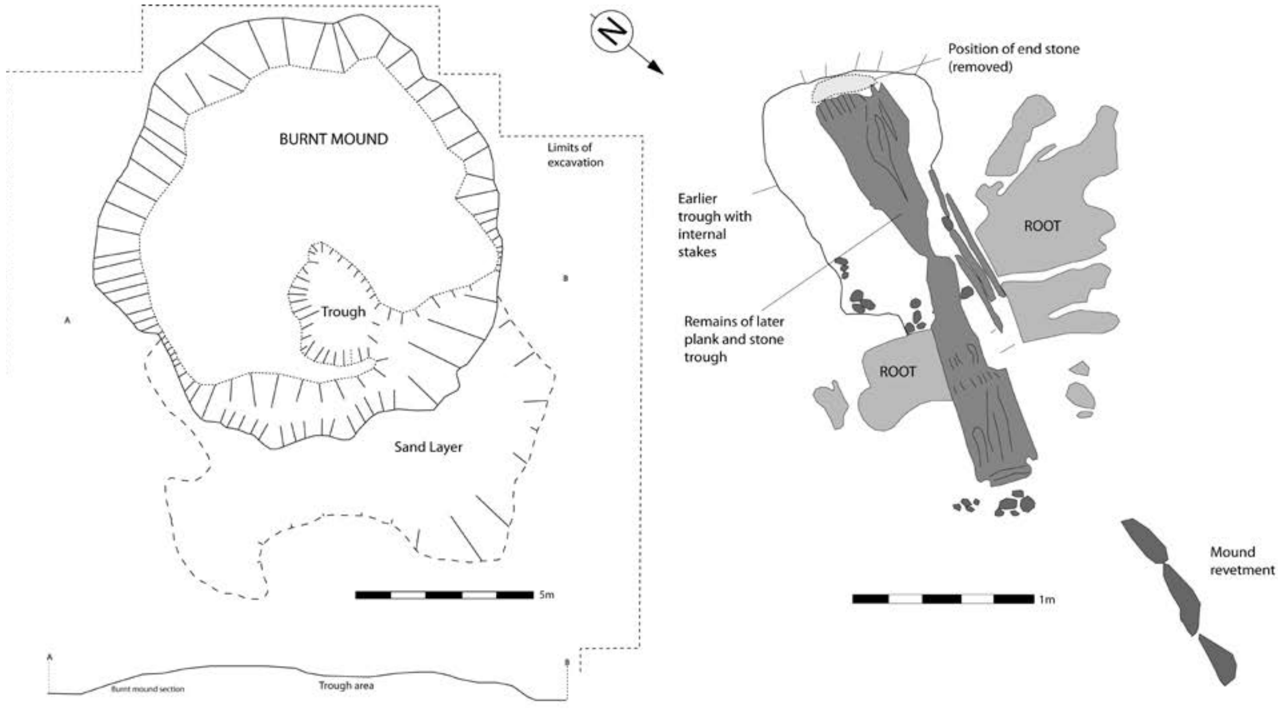

Figure 5.23. Burnt mound and separate trough phases at Gortaroe 1, (Area 3), Co. Mayo. Source: adapted from Gillespie 2001.

(2) Re-use after short interval

At a number of burnt mounds, the excavation record indicates that the site was temporarily abandoned before a new trough was constructed. This may have been a deliberate attempt to redefine the earlier example (McQuade *et al.* 2009: 112; Chapple 2008: 22–59; McGowen and Fallon 2010). As mentioned previously, in some cases, the dimensions of earlier troughs were maintained, while in other examples the original pit was enlarged or reduced in size depending on user requirements. For instance, troughs at Athronan 1, Co. Meath (MH38; Figure 5.21), consisted of two consecutive pit cuts on the same location, the second largely erasing the first (McGowen and Fallon 2010). The first pit consisted of a large sub-rectangular cut (F96) 1.5m in length and 0.84m in width with a flat base. While the base of the cut was 0.6m below the original ground surface, only 0.15m of the cut's original vertical extent survived being almost entirely removed by a second, broader pit (F82) in the same location. Only one shallow fill was identified within the original cut, a sample of hazel charcoal from which yielded a radiocarbon date of 1930–1750 BC (*ibid.*). Similarly, at Lissava, Co. Tipperary, a number of use phases were identified in the trough. The primary trough was re-cut and enlarged during a second Middle Bronze Age phase of activity. Both of these features were, in turn, cut again by an additional trough during another separate phase. This second phase of activity suggests that the site was temporarily abandoned and that the construction of a new trough was an attempt to redefine the earlier troughs (McQuade *et al.* 2009: 114).

At Lisdornan 3, Co. Meath (MH04), a large burnt mound was revealed in advance of the N11 Northern Motorway (Russell 2001). This measured 19.4m in length, 14.6m in width and 0.22m in depth and overlay a number of pits, including two troughs. The first consisted of a wattle-lined pit, which was subsequently replaced by a sub-rectangular, plank-lined trough (Figure 5.22). The former consisted of an oval pit measuring 1.85m in length, 1.3m in width and extended to a depth of 0.28m. The sides of the trough had originally been lined with a wattle lining, but this only survived along the northern and eastern edge of the trough. The surviving portions were made from up to eight strands of hazel rods supported by nine surviving vertical wooden stakes. One of these uprights is radiocarbon dated 2014–1561 BC, and can be compared with similar troughs dating to the Chalcolithic/Early Bronze Age (Hawkes 2015; see Chapter 4)

Similarly, at Gortaroe I, Area 3, Co. Mayo (MO31), a trough composed of a roughly hewn plank and end stones directly overlay an earlier plank-built trough, the basal timbers of which were still *in situ* and held in place by a series of stakes (Figure 5.23; Gillespie 2001: 75). The site was composed of a burnt mound measuring 11.75m by 10.5m with an average thickness of 0.75m. It consisted of burnt sandstone in a matrix of charcoal and peaty clay which also contained animal bone fragments and a hammer-stone. The mound had a hollow close to its centre, which overlay the trough area, an upright slab, a roughly hewn oak plank abutting this stone and three smaller upright stones perpendicular to the upright slab. The upright stone and the oak plank appeared to be contemporary as they were both set on or into the peat and abutted each other. An earlier wooden trough survived as three poorly preserved horizontal timbers and the worked ends of four stakes. The wood remains were alder (three pieces), hazel (two fragments) and willow (two fragments). The horizontal timbers are likely to have been basal timbers from a rectangular trough. The side timbers are likely to have been removed or displaced in antiquity, possibly when the timber from the later trough was inserted.

The mound at Kilbegly, Co. Roscommon (RM12), was irregular in shape with maximum dimensions of 8.2m by 6.3m, with a maximum thickness of 0.4m. A well preserved, oval shaped, wattle-lined trough was also identified on the site, positioned near the centre of the burnt mound (Jackman 2010). This consisted of a sub-oval cut measuring 1.62m in length, 1.12m in width and had a depth of 0.4m–0.2 m. This was lined by hazel wattle, caulked with woodland mosses (Figure 5.24). Samples taken from the wattle lining are radiocarbon dated 2134–1944 BC, 2129–1941 BC, 2032–1902 BC, 2020–1886 BC. A result of 1917–1692 BC for a moss sample suggests re-use, as the four dates from the trough wood indicate this may be some 200 years older. The possibility that the moss material was added several years after the construction of trough should be considered.

(3) Re-use after long interval

Radiocarbon evidence does indicate considerable periods of inactivity at some burnt mounds. For example, at Moneycross Upper Co. Wexford (WX16), the first phase trough is dated to the Late Bronze Age. This trough was returned to in the Early Iron Age, extended and re-lined with timber planks(Stevens 2010). The first phase of the trough was evidenced by four corner stakes of holly wood, which outlined a small rectangular trough measuring 1.25m by 0.85m. Four samples of these timber stakes were sent for radiocarbon analysis, producing calibrated age ranges of 1193–920 BC, 1188–918 BC, 1114–1097 BC and 1006–835 BC. This places the stake-hole structure of the trough firmly in the Middle to Late Bronze Age, centring on the period 1100–1000 BC. Contemporary with the construction of the trough, was an irregular raised clay platform. This was built to provide a dry 'working' area surrounding the trough. A small hearth was located in the southwest of the site, *c.*3m to the northwest of trough.

After the abandonment of this first pit, the trough was extended towards the north and west. Prior to the lining of the base and sides with split planks, the base was covered with a compact clay deposit to provide a level base, thus sealing the stakes of the first phase underneath. At the northeastern corner, two small upright stakes held the eastern side plank in place. Three samples of these ash timber planks were sent for radiocarbon analysis,

Figure 5.24. Early Bronze Age wattle trough with moss lining at Kilbegly, Co. Rosscommon. Source: Neil Jackman for VJK Ltd and Transport Infrastructure Ireland.

producing dates of 748–388 BC, 748–391 BC, and 750–396 BC. This places the plank structure of the trough firmly in the Late Bronze Age-Early Iron Age centring on an approximate age range of between 750–400 BC, some 300–500 years later than the stake built structure in the same trough. The trough was subsequently filled with burnt mound material, containing alder and ash charcoal and fire-cracked stone.

The Moneycross Upper findings are significant for the continued use of burnt mounds into the Early Iron Age. At Cahiracon, Co. Clare (CE21), an alder plank-lined trough dated to the Late Bronze Age was re-cut and re-lined with oak planks during the Early Iron Age (Grogan *et al.* 2007: 186). A similar trough, also in the townland of Cahiracon was returned to in that period and reduced in size with the dumping of a stone deposit (*ibid*.: 189).

Reference can also be made to two burnt mounds in close proximity at Islands, Co. Kilkenny (KK24) located in a marshy area close to a natural spring. The larger mound (Site A) measured 24m in length, 14.5m in width and 0.06m-0.6m in depth The main trough located under this burnt mound was a sub-rectangular pit lined with twelve alder planks. A sample of timber (alder) from the base of the trough has an Early Bronze Age date of (2120–1880 BC), indicating the primary phase of activity of the site. Within the upper layers of the mound there was a pit with gradually sloping sides and a rounded base which measured 1.44m in length and 0.58m in depth. This was lined with seven timbers, one of which has a Late Bronze Age date of 1130–910 BC, indicating a second phase of activity some 750 years after the first use of this site. Charcoal (hazel/alder) from the basal fill of a pit beneath a second burnt mound (Site B) produced a date of 1740–1520 BC, indicating an approximate 260-year interval between the use of both burnt mounds.

At Fauleens, Co. Mayo (MO58), two layers of burnt mound material represent separate phases of activity associated with two wood-lined troughs (Gillespie and Kerrigan 2010: 112). Trough B was used in the Early Bronze Age, with a hazel post-dating 2022–1785 BC, while Trough A was constructed in the Late Bronze Age, with a hazel post-dated 774–521 BC. The excavators suggest that the re-use of the site long after its initial ‘occupation’ suggests that it was ideally located to exploit the primary resources required for pyrolithic activity and so remained an attractive location for such processes in the Bronze Age (*ibid.*)

A Middle Bronze Age burnt mound at Sranagaloon 3, Co. Clare (CE60) contained two troughs and a pit sealed by a mound of heat-shattered stone. The large trough contained a number of timbers that may represent a dismantled or disturbed wooden lining. The western upper edge was lined with five stake holes connected to either fixing pegs for a lining or perhaps a windbreak. An AMS date from a middle fill of the trough indicates use between 1494–1399 BC. The second trough was much smaller and produced a contemporary date range of 1494–1324 BC. The abandonment of the site is indicated by a layer of peat over the burnt mound (*ibid*.) Following this peat growth, pyrolithic activity was carried out again at the site. This

is indicated by a burnt mound of compact, heat-fractured limestone and a shallow trough and a pit cut into the aforementioned peat. This survived as a shallow cut lined with eighteen individual timbers laid sided by side. This trough was sealed by a mound of heat-shattered limestone. Charcoal from the mound is dated 706–400 BC, placing the reuse of the site to the end of the Bronze Age period.

As mentioned previously, little is known of the chronological sequence of many burnt mound clusters. Recent research suggests that many were not in contemporaneous use. For example, at Borris, Co. Tipperary (TY61), burnt mound (Site A) was located on the northern side of the site, situated 30m to the north of Site B. It was located on the north-western area of the site and consisted of a Middle Bronze Age burnt mound with a single large, ovoid, irregular trough. Radiocarbon dating of timbers from a trough below the burnt mound returned a date of 1880–1660 BC. Site B contained thirteen potential archaeological features, seven of these proved to be archaeological, and included two troughs and five pits. Although, no mound or burnt spread was revealed, the evidence represented a denuded burnt mound site type. A Chalcolithic date of 2486–2299 BC from one trough feature suggests a possible hiatus of activity of *c.*420 years between these sites.

At Coonagh West 6, Co. Limerick (LK60), two burnt mounds were located flanking the River Shannon. One of the mounds overlay a well-preserved wood and stone lined trough, dated to the Chalcolithic period 2458–2203 BC (UBA-13268; 3840±26 BP). The second mound immediately to the south overlay a shallow pit and a linear cut feature. Alder charcoal from the latter is dated 1605–1433 BC (Birmingham *et al.* 2013: 72). This indicates an interval of *c.*800 years between the two sites, suggesting it was a preferred location for pyrolithic processes.

At Errew, Co. Leitrim (LM12), the remains of four pyrolithic sites were identified some 30m east of the River Errew (Péterváry 2007: 286). Clay platforms were constructed at each site into which a trough was placed. The construction method of the troughs varied in these sites. A stone-lined trough at the first clay platform was associated with a small deposit of fired debris dated 2200–1960 BC. A second clay platform 35m had a roundwood-lined trough caulked with moss. Charcoal from the associated burnt stone deposit is dated 1000–830 BC. A third clay platform was located further to the south, associated with a wattle-lined trough, possible hearth and burnt mound material. The fourth site lay 8m to the south and comprised a similar clay platform with a thin deposit of heat-shattered stone dated to 790–500 BC, but no associated trough.

The above examples question whether burnt mound clusters formed through a process of accretion or replacement over time. Here we must distinguish between successively ‘built’ and successively ‘used’ burnt mounds, as adjacent sites may have been in simultaneous use. In some cases, the dumping of mound material in close proximity represents contemporary water-boiling activities, while in other instances it represents an abandonment in favour of an adjacent site. The latter is well attested in the archaeological record, at sites such as Johnstown, Co. Carlow (CW03), Ballyline, Co. Clare (CE62), Doughiska, Co. Galway (GY01) and Ballyquirk Co. Kilkenny (KK32) (Breen and Clarke 2009; McNamara 2009; McKinstry 2010; Jennings and Coughlan 2011). While the close proximity of burnt mounds may relate to practical considerations such as flooding, lengthy periods of abandonment between sites may be a statement of social affiliation, expressing kin relationships, sodalities and other membership groups. The location of some of these sites in close proximity to earlier examples may be coincidental, however in others it could relate to some form of ancestral association. For example, lengthy periods of abandonment were noted between burnt mounds at Ballyclogh, Co. Cork (CO11), Islands, Co. Kilkenny (KK24), Errew, Co. Leitrim (LM12), Rathcash, Co. Kilkenny (KK41), Boherard, Co. Laois (LS15), Richill, Co. Limerick (LK65) and Sonnagh, Co. Mayo (MO43) (Lehane 1986; Hardy and Breen 2009; Péterváry 2007; Coughlan and Bailey 2011a; Danaher 2008; O’Connell and Ní Thóibín 2009; Gillespie and Kerrigan 2010). The use of each site for prolonged periods probably enshrined different memories of social occasions and historical events, which can sometimes be represented by deliberate depositions of artefacts and human remains. This may be seen at a number of mound clusters, including Killeens, Co. Cork (CO04), Coolroe, Co. Mayo (MO12), Clowanstown, Co. Meath (MH83), and Sonnagh, Co. Mayo (MO43). When constructed within or near older sites, burnt mounds made reference to the past through manipulation of a structured and meaningful action. By the appropriation of genealogical history and ancestral space, a sense of permanence and continuity was established (Murray 1995). This may have led to the formal abandonment of one site and the beginning of another.

(4) Change of use

Where scenarios of site re-use occur, these may not be related to the particularities of water-boiling but to other activities. Variation in site layout may reflect an adaptation of pyrolithic processes to changing functional demands, seasonal adaptations or local traditions. We should no longer view these sites as simply representing water-boiling activities exhibited archaeologically by a trough and a mound of burnt stone. Additional features identified in recent years suggest the technology was used in different ways, with the water-boiling process being just one of these (Hawkes 2015). In some cases there is evidence of radical transformations, where a site has its origins in the pyrolithic water-boiling tradition but it is later modified for another purpose. Whether these changes reflect fluctuating water-levels at a site is unknown, but does indicate an adaption of the pyrolithic process in later periods of the Bronze Age.

This is almost certainly the sequence at Cahiracon, Co. Clare (CE23; Figure 5.25), where an earlier water-boiling trough was replaced by a stone-lined roasting oven (Grogan *et al.* 2007: 190). The site consisted of a D-shaped burnt mound and a number of inter-cutting troughs representing at least four different use-phases. The first phase consisted of an L-shaped trough which was later re-cut and shortened during a second period of use. The trough was lined with stone flags during this phase with evidence of a large amount of burning from exposure to heat. After this episode of use, the trough was backfilled and abandoned. During a third phase, another large trough was cut through the eastern portion of the original trough pit. After another period of abandonment a final phase of activity was recorded on the mound, involving some burning events not associated with the earlier trough features. A charcoal sample from this final mound activity is dated to the Middle Bronze Age, 1520−1120 BC.

A site at Garranes in the Beara peninsula, Co. Cork, provideds evidence for two separate phases of activity, beginning with a typical burnt mound using the hot-stone/water-boiling technique (CO57; Figure 5.26). This consisted of a sub-circular stone-lined trough with an overflow drain and adjacent stone-built hearth. The pyrolithic process resulted in the deposition of fuel ash and broken stones in the trough vicinity. The limited occurrence of this fired debris suggests that the site was used over a short period approximately around 1493−1311 BC (O'Brien 2012: 127). This was replaced when the trough was deliberately backfilled, and a slab pathway and a possible roofed stone-footed structure was constructed over the earlier features for use as a cooking house for dry roasting, re-using the stone-built hearth of the earlier phase. A radiocarbon result of 910−801 BC from gorse charcoal taken from the final use of the stone hearth broadly dates this second phase of activity in this site (*ibid*.: 125). The absence of a water trough or any burnt stone residues in the interior suggests that this involved a different process from the phase 1 burnt mound. Instead of water-boiling, the hut may have been used for the dry roasting of food and can be compared with other stone-built huts with roasting ovens such as those at Drombeg, Co. Cork, Site D, Barrees, Co. Cork and Coarhamore, Co. Kerry (Fahy 1960; O'Brien 2009: 203; Hayden 1995). The site at Garranes provides clear evidence for a change in cooking methods during the Later Bronze Age, and can be compared with sites such as Ballinaspig More, 7, Co. Cork and Cahiracon, Co. Clare where there is evidence for a change from water-boiling to dry roasting in later periods.

Ballinaspig More 7, Co. Cork (CO43), has three principal phases of activity, involving the construction of three troughs and associated deposits, all superimposed one each other. The first phase was represented by a sub-oval trough and a series of associated stake-holes. The trough had been dug into an impermeable clay layer, and so naturally held water without the need for a lining. The burnt mound material generated during the use of this pyrolithic stone boiling formed a sealing layer above the surviving cut features. A sample of birch charcoal from the burnt mound material is radiocarbon-dated 2860−2490 BC. Trough 2 was dug into the burnt mound from this earlier phase and the underlying impermeable clay subsoil. A third trough to the south of Trough 2 in a similar alignment was cut through the same subsoils. This trough appeared to be contemporary with a northeast–southwest aligned ditch that functioned as a drain taking water into the trough. A distinctive feature of this trough, however, was that its base was oxidised to a bright pink colour, indicating exposure to intense heat. One possibility is that the trough functioned both as a hearth and trough, and was a possible steam bath (Hanley and Hurley 2013: 116).

An interesting feature of these two phases of the site is that after Trough 2 went out of use and was backfilled, Trough 3 was created and the site reused as a sauna/bathing place. Although it is difficult to estimate the intervening time period, a fill from Trough 3 is dated 1430−1130 BC, while the primary fill of Trough 2, representing its last use is dated 1500–1380 BC. The median dates for both of these features suggests an intervening period of some 150 years. While these dates support the stratigraphic sequence, the 'old wood' effect should also be taken into consideration.

The main focus of activity at Inchaquire, Co. Kildare (KD22), centred on the Early Bronze Age burnt mound with three associated troughs and a well feature (Hanbidge 2009). This first phase of activity also involved a storage pit that contained a flint assemblage interpreted as a processing toolkit including projectile implements (both finished and in stages of production). Two later phases of activity dated to the Middle Bronze Age. The first (Phase 2) was characterised by the presence of a stone-lined cist placed in the western corner of a large 'court'-like area. This was succeeded by Phase 3, which included the re-cutting and reuse of the cist as a trough. Both phases of burnt mound activity are associated with a relatively large animal bone assemblage that include some of the earliest evidence of the presence of horses within the Bronze Age.

The cist was quickly succeeded by a second phase of burnt mound activity, with the possible burial structure itself recut and reused as a trough. The excavator suggests that this re-cutting was probably responsible for the removal of any grave goods and human remains in the cist.

Numerous fragments of animal bone were recovered from the deposits within this trough, along with a few small fragments of cremated bone that could not be identified as human or animal bone (*ibid.*).

A similar site was excavated at Shankill, Co. Dublin (DNO2), where it has been suggested that a wedge tomb was built on top of an earlier burnt mound (Ó Néill 1999). Such an interpretation implies that the location was ritualised as an important burial place shortly after the earlier pyrolithic site was abandoned. The site began as a water-boiling area which had been constructed on a slight hollow on a prominent slope with underlying natural springs. At this

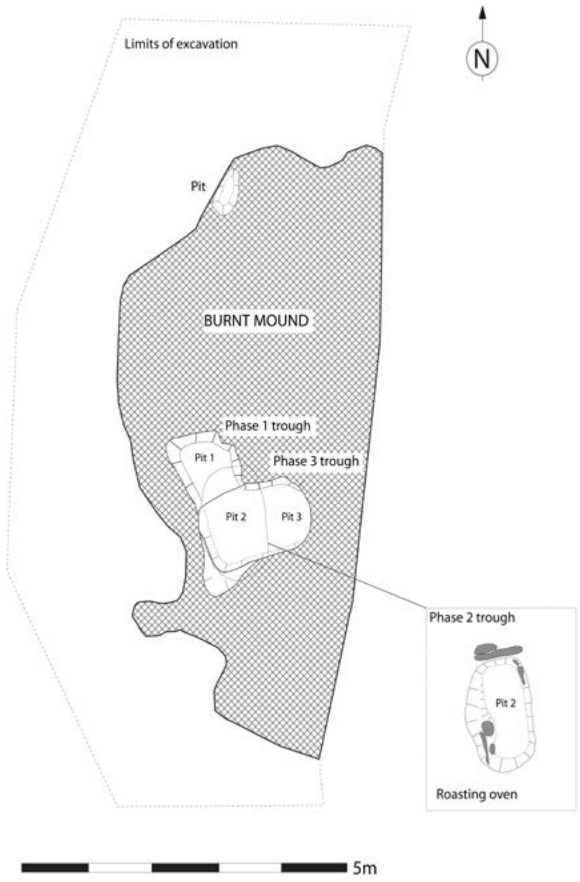

Figure 5.25. Partially excavated burnt mound at Cahirachon, Co. Clare, with three trough phases. Source: adapted from Grogan *et al*. 2007: 190.

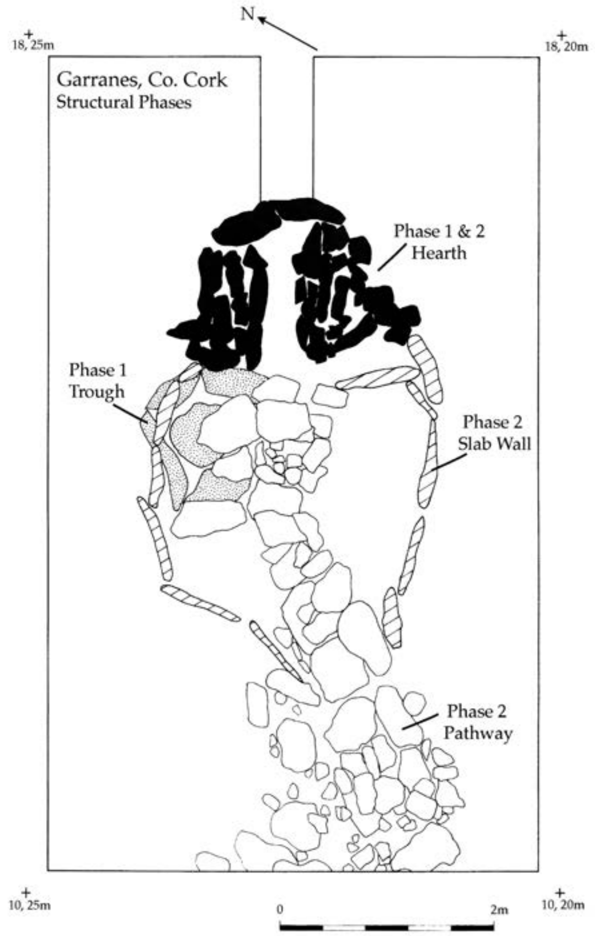

Figure 5.2. Plan of excavated features at Garranes, Co. Cork. two phases in this site are illustrated, including an early water-boiling operation and its replacement by a dry-roasting operation within a roofed structure. Source: William O'Brien UCC.

stage the site was well laid out, with a trough, a cobbled area, a fence line and a hut site. A fence line (possible windbreak) and cobbled surface lay immediately north of the trough, with the hut site positioned just to the north of the cobbled area.

Sometime after the pyrolithic site was constructed, large portions of burnt stone debris from the trough were pushed aside and a foundation-pit was dug into the slope. This provided a level base for the construction of a short 'megalithic gallery', which was double-walled and widened at its eastern end, an atypical orientation for Irish wedge tombs. The structure measured 2.35m in length (east-west), 1.5m in width at its western end, and 3.4m in width at the east. No capstones was discovered on excavation, however, large amounts of stone were interpreted as the remains of a cairn.

Though interpreted by the excavator as a wedge tomb, the Shankill structure is comparable to large, stone-built hearths from several other burnt mounds across Ireland. They are U-shaped settings of stones, sometimes several courses high, which are always open to the shorter end of the trough to facilitate the deposition of hot stones. Examples include those excavated at Killalough, Co. Cork (CO21), Garranes, Co. Cork (CO57), and Ballydowney, Co. Kerry (KY10). Radiocarbon dates from 18 sites where stone hearths have been recorded all date to the Middle to Late Bronze Age (1608–500 BC), and are associated with either rectangular stone-lined/wood-lined troughs or hollowed-out logs used for water-boiling. As the limit of excavation at Shankill was adjacent to the open end of the U-shaped setting, it is likely that this is a stone-built hearth associated with a trough that lies immediately outside the area of excavation. The structure relates to a separate phase of burnt mound activity, and is not a wedge tomb. It should be noted that no human burials were found at the site.

These episodes of re-use reflect fundamental changes from a pyrolithic water-boiling technology to a dry heat using hot stones. This re-use could be subtle or gradual; but at other times it was more sudden implying that quite dramatic shifts had occurred. Long temporal gaps between phases may indicate later 'invented traditions', or deliberate acts of forgetting and dislocation (Chadwick

and Gibson 2013: 8). As Bradley has suggested in relation to monument re-use, these changes could even have been accompanied by a symbolic slighting or stripping of the remains of the older construction (Bradley 1993: 98). A process of this kind may account for the possible symbolic burning of trough timbers seen at Killoran, Co. Tipperary (TY01), Ballywilliam, Co. Down (DW11), and Kilmainham 1, Co. Meath (Cross May *et al.* 2005: 305; Chapple 2007: 21−33; Walsh 209). Alternatively, these burning episodes may relate to some sort of non-funerary purification ritual or a 'closing event', deliberately decommissioning the trough when abandoned. This will be the subject of the next chapter, where it will be argued that the deliberate destruction or backfilling of troughs along with the deposition of artefacts represented intentional acts of decommissioning, permanently removing some burnt mound locations from cycles of re-use.

The revisiting of burnt mounds, and specifically the reuse and re-lining of individual troughs, shows that these locations were a permanent element in the landscape, even if the activity at each site was episodic. The re-use of a particular site may have been determined by a number of factors that could have operated collectively or independently. Firstly, some natural areas may have been deemed sacred by virtue of an earlier ritual association, while others may have had a commemorative importance in relation to earlier pyrolithic processes, connected with an ancestral history. Secondly, the choice of a particular location may have been influenced by certain practicalities such as the availability of resources (e.g. water, fuel and stone).

Thirdly, the choice of these locations may have been influenced by the proximity of permanent settlements and farmscapes. In most cases, it is likely that a combination of social and environmental factors determined the siting of individual pyrolithic sites within a wider settlement landscape and it can generally be assumed that the environmental factors that influenced the siting of burnt mounds in some way reflect the settlement pattern and economic concerns of their users. The connection to place is also important as previously discussed and it is likely that these depositions of burnt stone were long-lived actions that may have had genealogical association linked to previous inhabitations. By returning to the same site and re-using troughs and constructing new ones, this may have helped to legitimate the user's rights to the land and certain resources giving the site an additional time depth. Similarly, the formal deposition of objects may have taken place at critical stages in the life cycle of both settlements and related burnt mounds.

It is important to acknowledge that the evidence of preceding pyrolithic activity must have influenced in some way similar activity of later date at the same locations. The reuse of older sites may have signalled that the area was suitable for pyrolithc water-boiling and there were sufficient raw materials and natural resources in the environs to maintain a site. This association with a particular place probably led to a concern with genealogy. It is suggested by Pollard that 'acts of deposition on or after the abandonment of a settlement and by the construction of monuments over former occupation sites were permanent embodiments of place-values' (Pollard 1999: 88). For example, the clustering of burnt mounds in an area may have been part of the process of attributing significance to particular places. Bradley contends that the re-use of monuments helped to create a distinctive type of consciousness, one that involves a changing perception of time and place. Monuments, he argues, 'have an enduring quality and their physical presence is a constant reminder of a human past that can serve the needs of people in the present' (Bradley 1993: 5).

As outlined by Connerton (1989: 45-6), by incorporating earlier features into new ones, the past and present were threaded together into continuous and connected networks, allowing ruptures and instabilities to be smoothed over. A key factor in remembering is repetition. While earlier troughs were acknowledged, new structures were adapted or retranslated the original meanings, depending on the relevance they held for those societies at the time. Through repetitive action, social groups lay claims to commemorating earlier events, and instil a sense of continuity that reinforces links between past and present, often invoking important moments and monuments (*ibid.*) As observed by Gibson (2013: 119) 'new features were sunk into the mnemonic depths of the past, through sequential re-cutting, overlapping, juxtapositioning, incorporation and layering. This was the physical work of memory'. Renewal however, implies change as much as continuity and choosing to break with traditional practice may also have involved an explicit position on the relationship between the present and the past. After a certain period of time had elapsed it might have been necessary for communities to physically negate their memories of a certain process, hence the construction of morpohologically different troughs overlying earlier ones.

5.10 CONCLUSIONS

A number of significant issues have been highlighted with regard to the assumed age of Irish burnt mound deposits. It has been demonstrated through the existing radiometric data that a number of sites had a prolonged duration of use. This is usually only evident when a number of use-phases can be established, often in the form of multiple cut features. That has created some uncertainty in the way many single dates should be interpreted from some excavated sites and has highlighted the need for multi-context sampling. The distortion caused by the 'old wood effect', the problems inherent in dating mixed-entity samples, and the need to establish secure associations between radiocarbon samples and the features that they are intended to date have all been highlighted in previous studies (Ashmore 1999; Cleary 2007; Warner 1990; Becker *et al.* 2012). Others have also cautioned the quality of many radiocarbon dates from recent road development projects (Becker *et al.* 2012; Hawkes 2012). Similarly, the audit of radiocarbon

dates carried out as part of this study has demonstrated that, despite the enormous quantity of dates now available for pyrolithic sites in Ireland, a proportion of dates from both commercial and other excavations are problematic in terms of their sample and/or association quality.

Frustratingly, it appears from excavation reports that charcoal is sometimes selected from contexts that may be stratigraphically unsuitable and therefore possibly not associated with the use of pyrolithic technology. Charcoal is a suitable dating material where samples from sapwood or short-lived species are selected from securely stratified contexts. Occasionally, the samples are also selected from contexts in which other, more suitable material (such as trough timbers or animal bone) are present. The current weight of low-grade radiocarbon dates from some burnt mounds in Ireland might ultimately be remedied by changes in policy and practice. An awareness in the field of the specific questions being posed in relation to chronology might improve excavators to strive for optimum sample and association quality.

Nevertheless, more secure multi-context sampling at other sites confirms beyond any doubt that the use of pyrolithic technology was not solely a Bronze Age phenomenon. There is evidence that the use of such sites spanned 4000 years, beginning sometime in the fifth millennium BC in association with Mesolithic cooking. The burnt mound/water-boiling phenomenon does not appear in the archaeological record until the Neolithic, before the technology becomes widespread during the Bronze Age. A marked decline in the technology is evident in the Middle Iron Age, while a critical review of radiocarbon evidence reveals no evidence for an early historic burnt mound tradition (this is discussed further in relation to cultural context in Chapter 8).

Regional patterns are not apparent in Irish burnt mound chronologies. Anthony (2003), suggests that in Scotland, the earliest dates are confined to the Borders region and the Western Isles, however given the small percentage of sites for which dates are available, it is not possible to say whether such patterns are reflective of an overall trend, or merely represent a bias in sampling. The same might be said for Ireland where there is a slight concentration of Neolithic burnt stone sites in the east of the country. This may simply be a reflection of road development as many were uncovered on the M3 motorway.

It is essential to accept the limitations imposed by archaeological methodologies, such as the limitations of the radiocarbon method in dating burnt mound activity of very short duration, or the difficulty of establishing the internal chronology of sites used over long periods. A site may, for example, have multiple lifecycles but these might not always be recognisable, particularly if later disturbance has destroyed the necessary evidence. The selective use of datable material can also be a limiting factor in determining the true longevity of occupation, particularly where only a few samples are available. Awareness of these limitations when interpreting the archaeological record is vital in comprehending the complexity of burnt mounds and the multiple meanings that can be assigned to different contexts and deposits.

Chapter 6

The use and social significance of burnt mounds

The purpose of this chapter is to bring together the different strands of archaeological evidence concerning burnt mounds in Ireland, to consider the use of these sites by prehistoric societies. Various debates surrounding the use of these sites will be discussed, with reference to sources of evidence from approximately 1000 excavated examples in Ireland. The social aspect of burnt mound use is also considered.

6.1 INTRODUCTION: APPROACHES TO SITE FUNCTION

It is generally agreed that a pyrolithic water-boiling technology was employed in burnt mounds to heat water held in open-air sunken pits (O'Kelly 1954; Waddell 2000; Ó Néill 2009). This is supported by the location of these sites in waterlogged places, and an association with timber-lined troughs with complicated filtering systems and related water-drainage features (see Chapter 5). The difficulty, however, is interpreting how this boiled water was subsequently utilised. The usual interpretation is that these were cooking sites, a view encouraged by the early historical sources, folk memory (Ó Drisceoil 1988; Ó Neill 2005) and experimentation (O'Kelly 1954; Lawless 1990; Allen 1995; Hawkes and O'Driscoll 2011−2012).

Narratives related to burnt mounds have for a long time centred on the issue of function, which has led to some confusion as to the significance of this monument type. As the number of excavations increased in recent years due to infrastructure and other developments, some of the results have been used to advance new interpretations as to the use of these sites. Many excavators now favour multifunctional explanations due to the ubiquity of the technology and the many possible uses of hot water. People at different times in the past drew on the history and associations of particular forms of monuments and they changed them in accordance with their needs and the character of their own society (Bradley 1993: 74). Complicating this issue, however, is the visible form and features in these sites which seem to have remained the same over a very long period, no matter how their functions varied. The use of burnt mounds is not reflected in the surface appearance of these sites, but can be understood to some extent through excavation.

Where deposits of burnt stone are found, arguments can be made for the application of pyrolithic technology to the creation of a wide range of products, including cooking, bathing, brewing, dying, washing and the fulling of textiles. The presence of structural evidence in some sites can be equated with the use of these huts as steam baths. A review of the archaeological evidence provides new insights into the use of pyrolithic technology, particularly for cooking, and the model proposed here is of open-air communal feasting/food sharing hosted by small family groups, possibly as a medium for social bonding.

The development of pyrolithic technology was not based on a search for more efficient cooking techniques, but rather in the social context of its use. As Wright observed 'meals are everyday rituals of profound importance in social life, structuring daily social intercourse and reinforcing cultural values' (Wright 2000). If cooking was indeed the primary function of burnt mounds, it would not have been viewed as a mundane undertaking, but probably contributed in a meaningful way to the constitution of social relations.

6.2 LITERARY AND ARCHAEOLOGICAL SOURCES

Over the years, however, several commentators have questioned the use of burnt mounds as cooking places. This is partly a reaction against the views expressed in much of the early literary sources, which are now seen to be less relevant for sites of prehistoric date. The terminology used to describe these sites has also come under scrutiny. This includes the suggestion that the term *fulacht fiadh* should no longer be considered appropriate (in relation to pyrolithic technology), as medieval manuscripts such as the *Yellow Book of Lecan* and the *Book of Leinster* refer to the word *'fulacht'* as cooking on a spit rather than a pit in the ground (Kelly 2000; Ó Néill 2005). Based on similar sources, part of the 'cooking site' theory has been an assumption that burnt mound locations represent seasonal hunting camps reused over many years. However, if this were the case, these sites should occur in suitable hunting environments such as uplands and wetlands, and predominantly contain faunal remains from wild animals. A large proportion of excavated sites are instead located in low-lying agricultural land, while the faunal remains from recently excavated sites are dominated by domesticated animals such as cattle and sheep (Tourunen 2008). The radiocarbon evidence also greatly lessened the relevance of the early literary sources by placing the great majority of these sites a millennium or more earlier than the texts. The latter should now be viewed as a literary construct - a mythologising of these ancient sites in early medieval Ireland, at a time long after open-air water-boiling went out of use, when their actual purpose had been forgotten, even though they were common features in the landscape. This may have led to imaginative stories offering explanations

for these enigmatic mounds. Whether related to cooking on a spit or in a boiling trough, we can be confident that the term '*fulacht*' and its derivatives refer to some type of cooking activity. The term was probably adopted by later writers who recognised an ancient form of cooking from their understanding of the visible remains (Hawkes 2012).

This was first raised by Brindley and Lanting's dating of burnt mounds to the Bronze Age, which was the first study to question any connection with descriptions in medieval and later texts to practices involving cooking with stones. These authors argued there is no compelling argument to indicate that burnt mounds were primarily cooking sites, although their widespread distribution and apparently fairly regular use might support such a function (Brindley and Lanting 1990: 56). Consequently, burnt mounds became open to many different functional interpretations that involved the use of heated stones.

6.3 THE COOKING SITE THEORY: PRACTICAL CONSIDERATIONS

The interpretation that these were cooking sites is perhaps the most widely accepted explanation of their use. This is where the primary purpose was to cook food by means of transfer of heat from hot stones to water and then eventually to the meat. Support from this came from experimental work, initially undertaken by O'Kelly (1954) at Ballyvourney, Co. Cork, which confirmed that the typical features of an excavated burnt mound, namely a water receptacle, hearth and the burnt stone and charcoal, could indeed relate to the type of cooking processes described by Geoffrey Keating's *Foras Feasa ar Éirinn* (Ó Drisceoil 1988). O'Kelly had successfully demonstrated, that a piece of meat, wrapped in straw could be efficiently boiled in a water trough, a technique that has been replicated many times since (e.g. Lawless 1988; 1995; Allen 1995; Hawkes and O'Driscoll 2011−12).

The cooking interpretation has been challenged by some researchers (e.g. Barfield and Hodder 1987) on the following grounds;

• The absence of food waste (animal bone and plant remains) or any artefacts associated with the processing of food

• The often ambiguous nature of surviving archaeological remains in respect of site function

• Uncertainties about the relevance of early literary accounts of *fulacht fia*-type sites

• Possible alternative uses of hot water produced in this way

• The laborious nature of pyrolithic processes for the purpose of cooking

• The practicality of using certain rock types (limestone) for cooking in a water-boiling process.

Those who favour alternative explanations are rightly cautious, as excavation evidence has not tended to support the processing and cooking of animal meat. Hot stones may have been used for cooking (roasting/steaming/small-scale boiling) during the earliest stages of human occupation in Ireland (see Chapter 6 and 9). It is only during the Early Neolithic that pyrolithic deposits associated with definitive boiling troughs and domestic faunal remains indicate the earliest use of the technology was used for cooking (Hawkes 2014). The majority of sites are now dated to the Bronze Age, with the absence of faunal remains making it difficult to resolve their use as cooking sites. This lack of definite evidence for cooking has led to more unusual interpretations, some of which fit the archaeological evidence more than others.

The consideration of burnt mound function in the past has tended to be site specific, and has not incorporated evidence from the body of excavation evidence that is now available. The large number of these sites suggests everyday use, or at least frequent occupation. Cooking is perhaps the most likely function, but this should not exclude a small number of diverse or secondary uses. The varying shapes, sizes and depths of troughs are generally more amenable to cooking than full body immersion bathing, although textile or hide processing remains a possibility (Reilly and Brown 2013). The evidence for water filtration, particularly from well preserved troughs, may well have facilitated bathing or textile processing, but would also have been important for cooking.

The acidic nature of Irish soils is often used to explain the scarcity of faunal remains recovered from burnt stone deposits. Others have argued that the absence of animal bone at burnt mounds may have been the result of ritual disposal of bones after consumption, scavenging animals or that the users may have butchered and consumed the meat at another location (Grogan 2005; Waddell 2000). Even where alkaline soils are conducive to the preservation of bone, the stone used for the pyrolithic process is often sandstone, the acidity of which meant that food waste may not have survived. An important development in recent years is the growing number of excavations in more alkaline environments that have produced animal bone which has directed the focus once again on cooking and the use of its by-products, such as animal fat (Roycroft 2006; Monk 2007).

Ó Néill (2009: 172) recorded some 19 burnt mound sites in Ireland with faunal remains. The current study has identified 263 (23%) sites out of 1165 excavated examples with such evidence, a significant development in our understanding of these sites. At 67 of these sites, the bone is described as burnt and is often not clear whether it is animal or human. This bone has been recovered from troughs (28%), pits (25%), mounds (32%) and other related features such as hearths, stake/post-holes and deposits (12%) (Figure 6.1).

At 66 sites, bone has been obtained from more than two contexts on site reducing the possibility that the material is intrusive. Therefore, a large proportion of animal bone finds from excavated burnt mounds can be regarded as securely associated with the use of these sites.

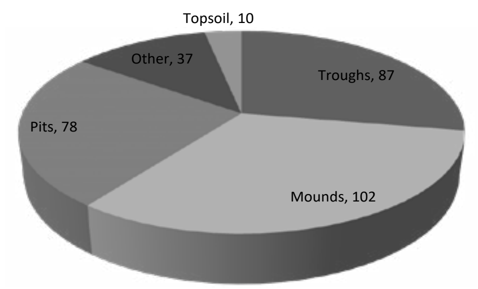

Figure 6.1. Context of animal bone recovered from excavated burnt mounds in Ireland.

Out of 14,789 animal bone fragments recovered from burnt mounds since 1950, 3,973 can be identified to species (Figure 6.2), with 67% of the remains identified as cattle, followed by sheep/goat (11%), pig (8%), deer (6%), dog (5%) and horse (3%). Some 9,546 fragments cannot be identified to species due to the high degree of fragmentation or as a result of burning. Burnt bone accounts for a high proportion of these unidentified remains and was only found by the bulk sampling of certain features and deposits. Unfortunately, this was not undertaken at most excavated burnt mounds. Even when the number of samples taken is reported, the size of the sample processed is limited. Variations also arise depending on the way the site was excavated. In many instances, the mound material might be removed rapidly, while features such as the trough were excavated with greater care. The different recovery techniques may also give rise to different interpretations. This is certainly a factor in relation to burnt mound investigated during road developments where, in many cases, only the base of features such as troughs and pits survive.

The recovered faunal remains often survive in poor condition and assemblages are usually too small to put forward any reliable statistics of age/sex slaughter patterns.

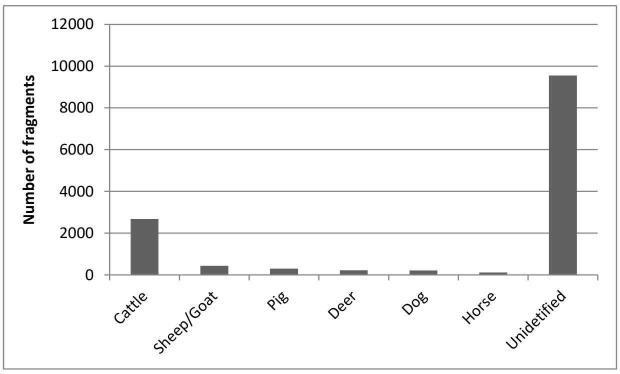

Figure 6.2. Range of animal species identified from excavated burnt mounds in Ireland.

Most assemblages consisted of less than ten fragments of bone, with the predominance of teeth reflecting poor preservation in acidic soil conditions (Figure 6.3). One would expect a larger number of bones recovered from burnt mound deposits in alkaline environments, where limestone was used in the boiling process. Examples include sites at Fahee South, Co. Clare (CE01), and Inchagreenoge, Co. Limerick (LK45), as well as five burnt mounds excavated along the N18 Oranmore to Gort Road Scheme (Delaney and Tierney 2011). In these cases, the firing debris consisted mainly of heat-shattered limestone and the presence of animal bone suggests that the sites may have been used for the processing and cooking of animals. This is significant as the potentially caustic nature of limestone, when heated and immersed in water, has been used as an argument against the interpretation of such sites as cooking places (Dennehy 2008; see Cleary and Hawkes 2013 for further discussion).

This adverse chemical reaction may also be the reason why sandstone and other siliclastic rocks favoured in certain instances, although it has observed that the quantities of calcium carbonate produced in the heating of water would not be harmful if the meat was protected and wrapped in vegetation or straw (Grogan *et al.* 2007: 98). Limestone also has varying chemical and geological components depending on the source, so some lithologies would react differently to others. This may be the reason why in certain boiling experiments, limestone use proved to be problematic (Lawless 1990: 8), while in others it was quite successful (Allen 1995).

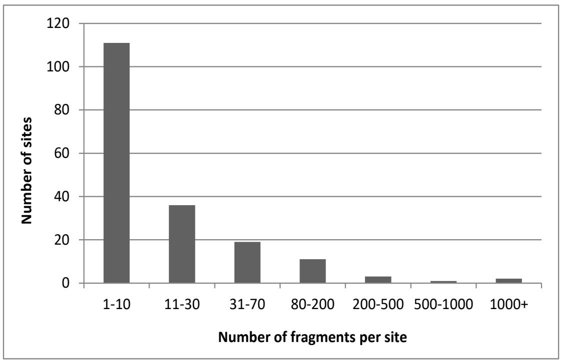

Figure 6.3. Size of fragmented bone assemblages recovered from excavated burnt stone deposits in Ireland.

Larger animal bone assemblages at a number of sites contribute significantly to our understanding of burnt mounds as possible cooking-places. For example, an estimated 1000 fragments of bone were recovered from a number of sites including Inchirourke, Co. Tipperary (TY63), Inchaquire, Co. Kildare (KD24) and Inchagreenoge, Co. Limerick (LK45). The faunal remains from the latter site include cattle, pig, horse and sheep/goat. The range of skeletal parts suggests that the animals were slaughtered, butchered and eaten on the site, and the age ranges are typical of animals raised for both meat and secondary products (Grogan *et al.* 2007: 282). Evidence of butchery has been recorded at some 30 excavated burnt mounds and is often rarely identified due to the

fragmentary nature of the surviving remains. For example, a red deer humerus showing marks of butchery at Balgeeth, Co. Meath (MH32), 'clearly represents the remains of a shoulder of venison that was cooked at the site' (McCarthy 2010). Red deer was present in eight of the excavated burnt mounds along the Dunshaughlin Sewerage Scheme in Co. Meath, with crudely smashed meat-bearing limb bones were present in all samples (*ibid*.). The presence of long bones is associated with the exploitation of animals as a meat source, especially species such as cattle and sheep/goat (McCormick and Murray 2007). This was the case at a cluster of burnt mounds in the townland of Kilbeg, Co. Westmeath (WM32–40); Caltragh, Co. Sligo (SO07 and SO09); Caheraphuca, Co. Clare (CE45 and CE49); Hughestown, Co. Roscommon (RM03); Attireesh, Co. Mayo (MO23); Ballinacurra, Co. Limerick (LK29); Athronan, Co. Meath (MH38); Cherryville, Co. Kildare (KD08); Clowanstown, Co. Meath (MH82); Cherrywood, Co. Dublin (DN04); Baysrath, Co. Kilkenny (KK34), and Clashnevin, Co. Tipperary (TY). At Ballinrobe Demesne, Co. Mayo (MO06), the concentration of cattle bones derived principally from the butchery of two animals under 2.5 years of age, with the sample consisting mostly of meat producing upper limb bones (McCarthy 1994).

Tourunen (2008: 38) observed that the processing of a large carcass can be divided into three different phases: slaughter (including skinning and removal of the horn cores), primary butchery (carcass dismemberment) and secondary butchery (preparation for cooking). Bones with little meat around them, such as skulls, jaws and lower leg bones should be abandoned or discarded in the initial place of slaughter. Their presence at some excavated sites indicates that animals may have been slaughtered on site and not introduced as processed carcasses. At Burrow or Glenanummer, Co. Offaly (OY07), butchered animal bone was recovered from a compacted burnt stone platform revetted by a number of timber planks. This platform was separated from the trough suggesting it may have functioned as an area for the slaughter and butchery of animals (Coughlan 2009). Some stake-hole clusters found at burnt mounds have also been interpreted as possibly forming tripod arrangements for the raised butchery of animals or the collection of blood (Delaney and Tierney 2011).

Assuming that the representation of faunal remains reflects the economic and dietary situation, there is a clear indication of the importance of domestic cattle in the local economy during the Bronze Age. Even though cattle dominate the bone assemblage from excavated burnt mounds in Ireland, in some cases it is not the main species present with other domestic and wild animals used for food consumption. At sites such as Holdenstown, Co. Kilkenny (KK37), Sonnagh, Co. Mayo (MO51), and Correagh I, Co. Westmeath (WM41), pig dominated the assemblage with the latter site producing evidence of butchery in the form of a cut marks visible on the surface of the bone. Analysis of the faunal remains showed that the pig jaw fragments could have all come from a single adult male individual aged 17–19 months suggesting that the pig was slaughtered during the autumn of its second year (Gillespie and Kerrigan 2010). Similar conclusions were drawn from the pig remains at Ballinrobe Demesne, Co. Mayo (McCarthy 1994). All the animal bone remains recovered from burnt mounds excavated at Killoran, Co. Tipperary were identified as sheep (Cross May *et al*. 2005). However, as these remains survived in poor condition, and were predominately from denser bone such as teeth, this is more likely to reflect the acidic soil conditions.

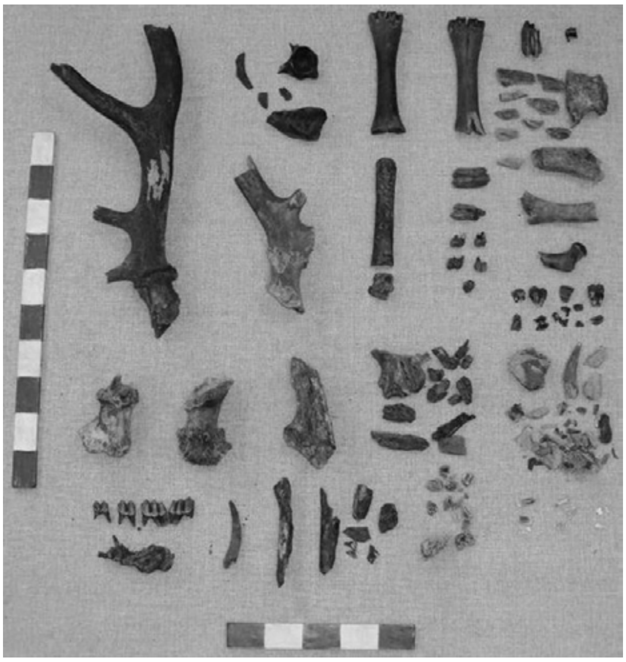

Figure 6.4. Fragmented animal bone assemblage recovered from burnt mound at Coolroe, Co. Mayo. Source: Richard F. Gillespie 2010.

The hunting of red deer also seems to have played a significant role in some sites. While many samples contain antler fragments, the processing of venison is reflected in the butchered post-cranial bones. At Coolroe, Co. Mayo (MO12), red deer formed the major part of the assemblage, accounting for 81% of the identifiable assemblage (Figure 6.4). The sample consisted mostly of antler fragments from adult male deer. In all, 91 fragments of red deer were identified including antler, teeth and post cranial remains. The presence of three unshed burrs, two chopped humerii, a pelvis with clear chop marks and butchered post cranial bones indicates that the deer were hunted and eaten (Gillespie 2010). At Kilmessan, Co. Meath (MH35), the extreme base of an antler set was attached to one of the skull fragments indicating that red deer was hunted before the males lost their antler in late spring (McCarthy 2010). Red deer remains are generally scarce on Bronze Age sites but have been recovered from 39 burnt mounds and are particularly common in Chalcolithic and Early Bronze Age contexts.

Venison appears to have been a relatively significant food item at Fahee South in Co. Clare (Judith Monk, pers comm.; Figure 6.5), however this meat was more significant at sites such as Kilmessan 2, Co. Meath (MH36); Coolroe, Co.

Mayo (MO12); Culiaghmore, Co. Roscommon (RM14); Kilbeg 4, Co. Westmeath (WM35) and Dunlo, Co. Galway (GY32). At Kilbeg 4, Co. Westmeath (WM35), the bones retrieved were two antlers and one scapula, which most likely were from red deer. The scapula was in a very poor condition so the identification is slightly uncertain. Both antlers had been cut up and it is suggested that these may have been used in the production of bone objects.

Figure 6.5. Red deer antler and some teeth fragments recovered from burnt mound at Fahee South, Co. Clare. Source: Alan Hawkes

Deer bone was also recovered from burnt mounds along the Carlow Bypass at Busherstown (CW06), Ballybar Lower (CW10) and Johnstown (CW05). Tourunen (2008) found that bones from deer were quite uncommon, but the remains that were present were either from antler or from the lower parts of the leg. This may indicate that bone implements may have been manufactured at some of these sites. For instance, along with the chopped deer antler at Kilbeg, Co. Westmeath, worked deer bone was recovered from a pit at Ballybar Lower, Co. Carlow (CW10), while a worked horse metatarsal and antler cut-off were retrieved from a burnt mound at Moone, Co. Kildare (KD33). At Inchagreenoge Co. Limerick (LK45), worked bone items include the base of an antler with a hole drilled through it, perhaps a handle, and a sharpened point for making perforations (Grogan *et al.* 2007: 282). At Correagh 1, Co. Westmeath (WM41), an unusual shed deer antler was perforated and possible used as a haft with some type of implement mounted in the large oval perforation through the beam.

While acknowledging the problems with sampling at these sites, no burnt mounds in Ireland have produced fish bone or mollusan remains, which is surprising given the proximity of many sites to coastal areas, lakes, rivers and other large bodies of water. It has been suggested that pyrolithic technology was used in the cooking of molluscs in shallow roasting or steaming pits during the Late Mesolithic in Ireland (Chapter 6 and Chapter 8). The cooking of fish using a water-boiling technology during the Bronze Age is more difficult to establish. That said, fish bones recovered from a trough at Meur, Sanday in the Scottish Isles is relevant, as the material within the trough was interpreted as a final deposit from the last boiling episode dated to 790–420 BC (Toolis 2005). Boiling fish in this manner, however, may not have been practical given the process involved. Interestingly, pottery sherds recovered from Meur, displayed signs of having been immersed in water and are comparable to examples found at Tangwick burnt mound, also excavated in the Scottish Isles (Moore and Wilson 1999). This raises the possibility that ceramic vessels may have been placed within boiling troughs to prepare these resources. Similar evidence is absent from the archaeological record in Ireland and it is likely that if fish was cooked, it would have been more efficient to do so on hot stones or in some form of earth oven or steaming pit. Ethnographic accounts illustrate how a variety of fish, and shellfish could be cooked using hot stones in this manner (Thoms 2008).

Recognising that the archaeological record is a palimpsest of repeated activity, the stratigraphic resolution of burnt mounds is an acknowledged problem, particularly when many examples survive as levelled spreads of heat-shattered stone. The most common finds recovered from burnt stone sites are flaked and modified stone tools, some of which can be dated to the Bronze Age. The present study indicates that 268 sites contained such material, sometimes in great quantity and, in a number of cases, with numerous waste flakes that indicate flint knapping. Moreover, the presence of numerous flint and chert scrapers from these sites, along with blades and their associated re-sharpening débitage, suggests that processes relating to the butchery of animals and the processing of their meat could have taken place.

It might be assumed that the only evidence from excavated burnt mounds pertaining to cooking is the recovery of faunal remains. However, 'cooking' is a wide-ranging culinary term that incorporates many different foodstuffs and, should not be viewed solely in relation to the preparation of meat. As discussed elsewhere, pyrolithic technology has been used in the past to cook a wide range of foodstuffs and given the use of hot stones for processing root foods in other cultures, the possibility exists that foods other than meat could have been processed using these methods in Bronze Age Ireland. Plant remains, however, are rarely recovered from burnt stone deposits and are less durable than bone, though the waterlogged condition of many burnt mound sites should make their preservation possible. That said, the discovery of macro-botanical remains of charred and un-charred seeds and nuts at some sites does indicate that plant gathering/processing/consumption may have been carried out at some burnt mounds. For instance, at Coolderry 2, Co. Tipperary (TY35), a circular trough with a basal layer of organic material pegged into place was divided in two by a single plank. A quantity of hazelnut shells were found in the smaller section of the trough and the excavator suggests that the plank may have functioned as a division to designate different functions to different areas within the trough (Long 2009). The majority of the hazelnuts within the trough were found east of this piece of wood. Hazelnuts were an important part of the prehistoric diet, and occur frequently on prehistoric sites and those preserved by charring or waterlogging likely represent

a small fraction of what might have been consumed on the site. The high volume of hazelnut shell present may indicate that they were being used at the site, rather than accruing naturally or accidentally occurring if hazel wood was being brought to the site. Hazelnuts have a bitter brown skin on the seed, which can easily be removed if the nuts are boiled for a short period and then immersed in cold water (blanched). The possibility that this may have been occurring in the trough of Coolderry 2, Co. Tipperary (TY35), should not be ruled out. Although not supported archaeology, the discussion does raise the possibility of liquid-based food produce being boiled in these troughs (see page 179).

Some attempt has been made to provide positive evidence of cooking through residue analysis, a process which has shown some success in relation to Bronze Age and Neolithic ceramics. The technique has been used to test for lipids from a number of potsherds found in a burnt mound from North Uist in the Western Isles (Armit and Braby *et al.* 2002). The remains were found to contain residual fat, probably from sheep. No such studies have been undertaken in Ireland, where pottery is only rarely found in burnt mounds (see Chapter 5). Furthermore, pottery use these sites cannot be directly related to the use of pyrolithic technology.

Although lipid analysis has rarely been applied to archaeological materials other than pottery, the technique has been carried out on samples from the fills of a number of burnt mound troughs in Ireland (Finch 2007) The results of these analyses have been disappointing and further research is required. The samples consisted of charcoal-enriched material containing moderate ash particles but no residues could be detected. This is not surprising for the natural clay-silt materials and it must be concluded that the intensity of heat/combustion treatment of the black samples was such that no recognisable organic molecules survived (*ibid*.). The technique was also carried out on a soil sample taken from the fill of a trough at Sturdy Springs, Teesdale, excavated by Durham University. The analysis failed to produce any evidence of animal fat and only traces of plant leaf waxes were found (Thelin 2007). A wide range of lipid compound classes were detected in cemented organic residues and in the charcoal samples from a number of slab-lined pits associated with burnt stone in Arctic Norway (Heron *et al.* 2010). Samples submitted for analysis included cemented organic residues on the stone slabs, soil fills, fire-cracked rock and charcoal samples reported as being greasy or oily. Analysis has concluded that these stone-lined pits were used to extract oil from the blubber of marine mammals during the medieval period (*ibid.*)

Given the degraded and truncated remains of many trough pits found in recent years, selecting suitable samples from secure trough deposits is problematic. Furthermore, it is likely that many were cleaned out after use and the sediments left *in situ* represent naturally accumulated silt deposits overlain with slipped mound material. An alternative approach may be to sample structural timbers from preserved timber troughs in an attempt to extract trapped animal fats. Experimentation has demonstrated that fats generally rise to the surface of the water during boiling (O'Kelly 1954; Lawless 1990; Hawkes and O'Driscoll 2011−12) and residues are often left on lower side planks when water is emptied (Figure 6.6 and Figure 6.7). However, a number of issues remain unresolved such as the degradation and/or contamination of samples, which may prevent wide-scale application of this technique without controlled sampling. It is also possible that if any fats were isolated during the boiling process they may have been skimmed off the surface as a secondary by-product and used for other purposes, such as leather processing, for making woollen garments waterproof and possibly for making rush lights (Monk 2007).

It is also possible that lipids may become trapped within the heated stone itself during the process as they would often be in direct contact with the meat itself or the fats which are being expressed. Thoms (2008) suggests two kinds of alterations from the heating of stone. Firstly, as mentioned before, the stone undergoes a physical change, i.e cracking and colour change. Secondly, the affected stone absorbs other materials such as food residues, charcoals and ashes, which is attested to by the blackening of many stones uncovered during excavation. Blackening of a rock is the result of different cooking residues deposited on hot stone such as tars, soot, charcoals and ashes. The nature of cooking residues depends on the use of the stone as a stationary hearth element or participating in the culinary activities such as boiling or roasting (Dumarçay *et al.* 2008: 345). Therefore, there is considerable promise in the identification of plant chemical signatures and microfossil lipids on fire-cracked stone associated with pyrolithic features (Thoms 2008: 452).

However, unlike the situation with ceramics, lipid analysis of stone materials has not been widely used in archaeology. Buonasera (2005: 958) has observed that it is not known how different rocks will absorb lipids, or in what quantities and types of lipids may occur due to natural processes (i.e. absorption from surrounding soil and decaying organic material). That said, there has been some success elsewhere in using lipid analysis of burnt sandstone pieces and ground stone tools to interpret subsistence change (Quigg *et al.* 2001). The internal matrices of the burned sandstone rocks in a south Texas site were targeted for lipid extraction because absorbed residues are better protected from oxidation and contamination (*ibid*.: 285). This was confirmed through experimentation. Almost all the stone selected for analysis yielded measurable amounts of lipids, and provided subsistence information for a site lacking faunal or macrobotanical remains. A similar study conducted by Buonasera (2005: 957) established that while some of the burnt stone may contain lipids absorbed from cooking activities, lipids were also recovered from off-site rocks. Therefore, before reliable interpretations of culturally introduced lipids can be made, a more thorough study of the types and amounts of lipids

Figure 6.6. Fat residue on surface of water during boiling experiment by the author at Rathbarry, Co. Cork. Source: Alan Hawkes

Figure 6.7. Fat residue on side planks of trough when emptied of water during experiments at Rathbarry, Co. Cork. Source: Alan Hawkes

present in rocks due to natural processes is necessary. As an alternative to sampling trough sediments and timber planks for lipids a study to test whether measurable amounts of fatty acids could be extracted from burnt stone might be more successful and would enhance our understanding of these sites as possible cooking places. In 2016, the author established a new pilot study to explore this issue by sampling burnt stone from an acidic burnt mound environment, where no bones were preserved. It was hoped that conducting residue/lipid analysis on burnt stone samples would establish whether this site was once used to boil a meat-based meal. Two burnt stone samples were analysed from the fill of a boiling trough. The amount of lipid residue recovered from the piece of granite was about six times greater than that extracted from the schist/sandstone-like rock. This difference likely stems from the position of the rock within the pit. The granite either absorbed more fats and oils from the foods prepared and/or the fats and oils were better preserved. Despite this difference, the relative fatty acid compositions of both residues were similar and resembled the decomposed cooking residue of large herbivores such as cow or deer. Cholesterol, which is a sterol associated with animal foods was present in one residue (Malainey and Figol 2017). This is not an exact science and precise identifications to species level are not possible, but broad categories of food can be recognised (e.g, plants, large herbivores, fish) rather than individual species of plants and animals. While the results from this pilot study are significant, they must be viewed with a degree of caution. Even though fatty residues were detected from both stones, the sample size is considerably low and the results cannot be taken to suggest that all burnt mounds were used to boil meat products for consumption. Further work is under way to determine if the results at this site are erroneous or whether this is a true reflection of pyrolithic sites of all periods.

Wandsnider's study of food composition and heat treatment provides significant information with regard to the application of pyrolithic technology (Wandsnider 1997: 15). She explains that lean meats are boiled to restore moisture, which will assist the action of digestive enzymes. Moreover, fatty meat tissues may be boiled to further lipid hydrolysis and to melt and express tissue lipids, which may then be recovered and used for other purposes, a point recently highlighted in relation to Irish water-boiling sites (Monk 2007). The boiling of meat produce may have been the preferred method for cooking recently killed animals. Fresh meat was seen as tough and barely edible amongst the Greeks and Sythians (Durard 1989: 103; McCormick 2009: 408). Boiling meat was commonly viewed as an efficient cooking method to conserve fat in meat and bone, as opposed to roasting it on an open fire, which can be wasteful (Abe 2005: 119; Nakazawa *et al.* 2009: 692). Extracted fat could also have been used for nutrition to deal with unpredictable food resource depression (Nakazawa *et al.* 2009: 692). Evidence for marrow extraction is known from the archaeological record, however if the bone is subjected to high boiling temperatures, marrow becomes molten and could melt through the foramen (Outram 2002). Boiling was an essentially important technique used to extract bone grease among Upper Palaeolithic hunter-gatherers in Europe. The process involved smashing the bone into small pieces and boiling it in order to extract the grease. The resulting pattern will be large numbers of small pieces of spongy bone accompanied by larger shaft splinters. The fragmented nature of much of the bone remains from burnt mounds could account for this process taking place, however this remains speculation.

The small number of animal bones recorded at most burnt mounds need not imply that the cooking of animals was of minor importance at these sites. The evidence from many recent excavations strongly suggests that cooking was a primary function of a large proportion of burnt mounds. The formal organisation of some sites, their sustained use and separateness within the contemporary settled landscape and the laborious nature of the process concerned, suggests that cooking may have taken place within a cycle of feasting events and not as a daily routine.

6.4 COOKING FACILITIES

A number of possible cooking applications can be proposed for burnt mounds in Ireland (Figure 6.8). This is based on the surviving archaeological remains which can be compared with the ethnographic and archaeological record elsewhere in mainland and north-west Europe. Smith (2000) described six basic types of 'cook-stone' facilities common in North America, versions of which were used by hunter-gatherers throughout the Northern Rockies and beyond. These include: (1) earth oven in a shallow pit with rocks heated therein; (2) earth oven in a shallow pit with rocks heated in a nearby hearth; (3) surface oven or hearth with rocks heated therein; (4) steaming pit with rocks heated in a nearby hearth; (5) stone boiling in a pit with rocks heated in a nearby hearth; and (6) stone boiling in above-ground containers with rocks heated in a nearby hearth.

Pit features accompanying burnt stone deposits in Ireland may have functioned in a similar manner. Two types of cooking may be proposed based on different heat transfer, namely moist heat cooking and dry heat cooking. Identifying the purpose of different pits is complicated by the considerable variation in size and morphology. This is illustrated by the multitude of diverse pits identified in recent years filled with deposits of burnt and fire-cracked stones. While these hot-rock cooking methods may have varied considerably, this generally involved some version of roasting, steaming or boiling. The repeated use of a suitable location also resulted in a large mound or mounds of waste-firing material and may sometimes contain multiple types of cooking apparatus. It is not uncommon for unlined pits of varying sizes to accompany timber-lined troughs. In many cases these features do not display evidence for in situ burning, which makes their interpretation difficult. The occurrence of oxidized and burnt sediments, as well as charcoal, may be indicative

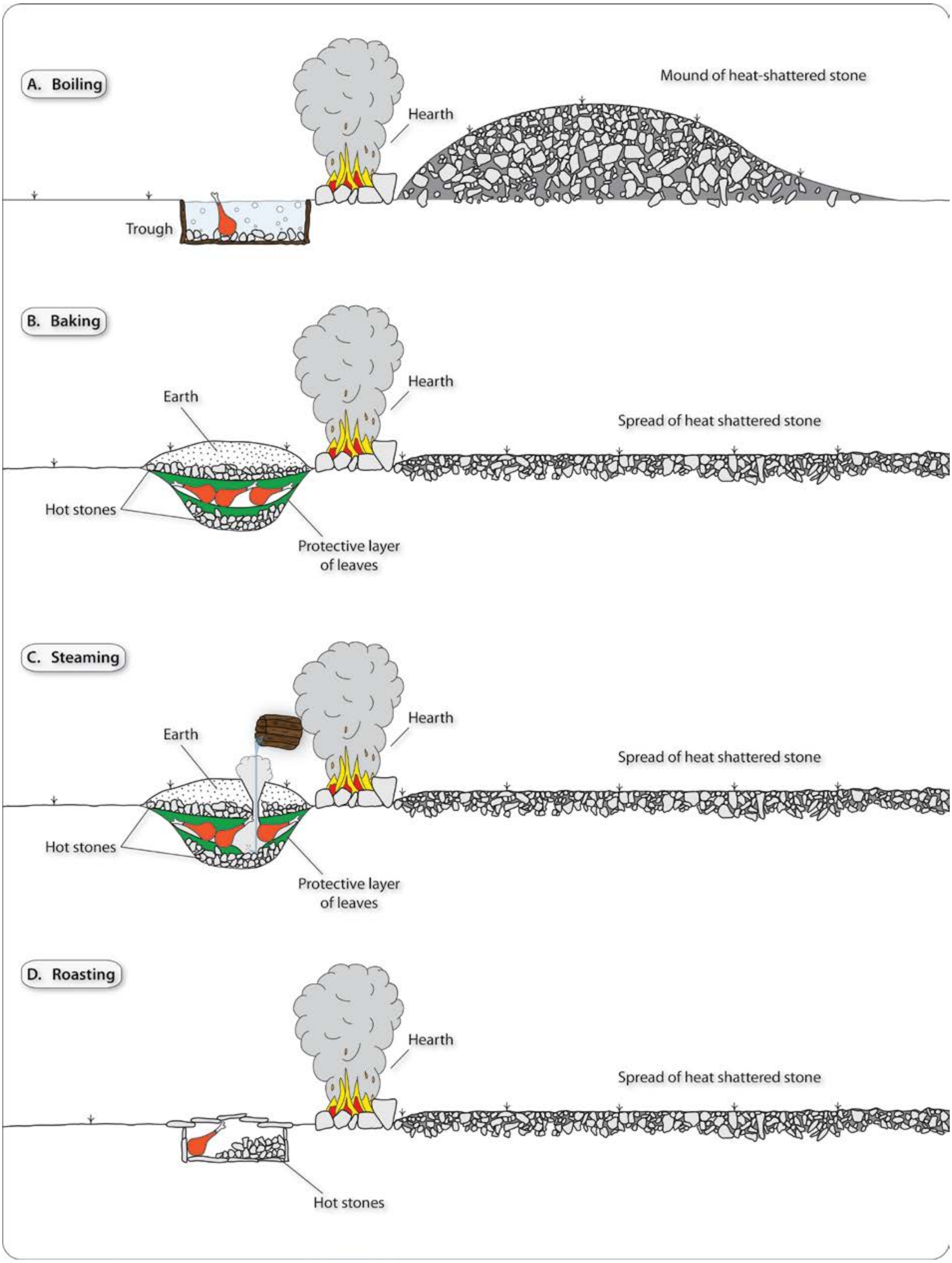

Figure 6.8. Features connected with cooking using pyrolithic technology in prehistoric Ireland. Type 4 and Type 6 examples are not represented here. Drawing produced by James O'Driscoll

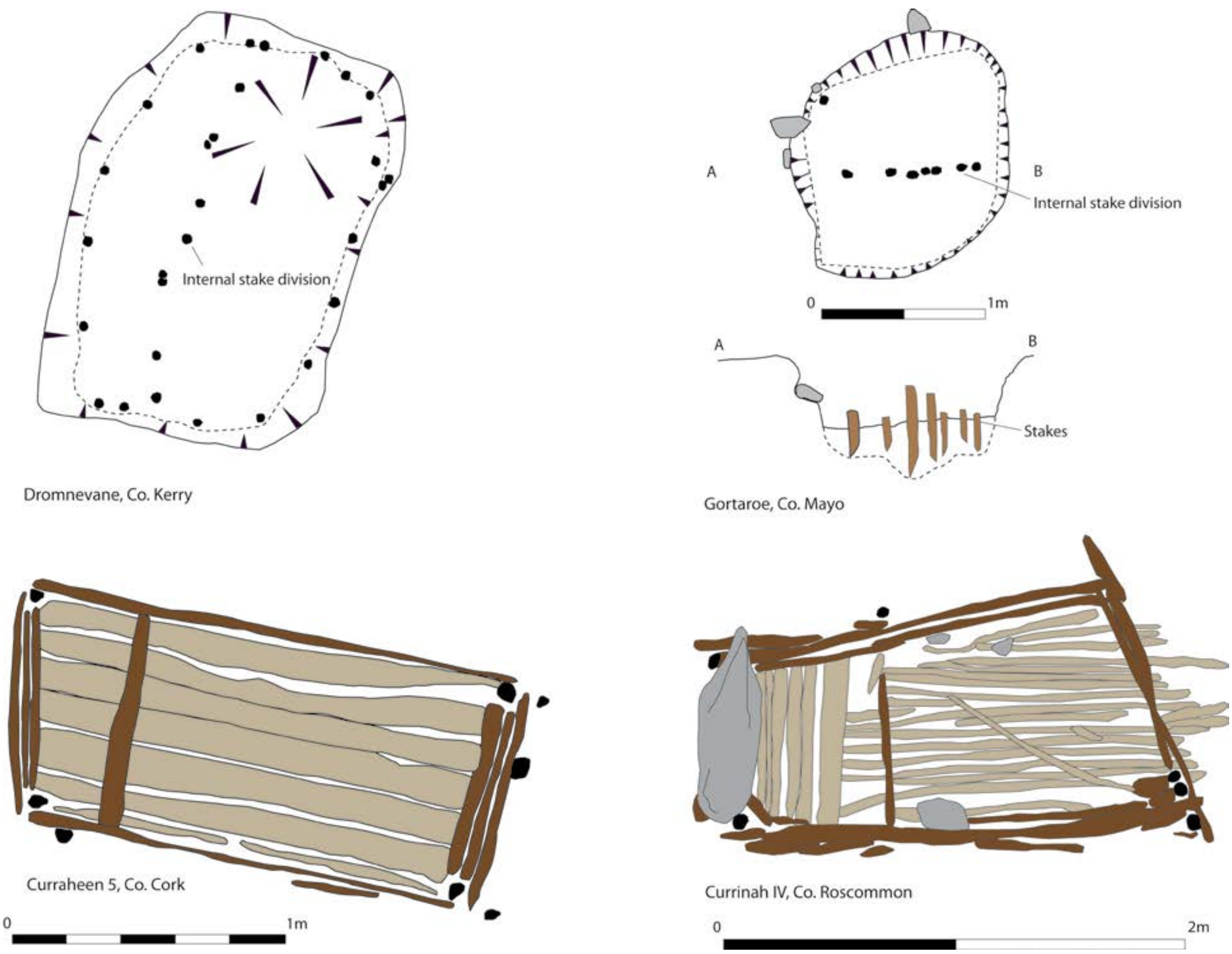

Figure 6.9. Divided troughs at Dromnevane, Co. Kerry (KY21a), Gortatroe, Co. Mayo (MO27), Curraheen 5, Co. Cork (CO37E) and Currinah IV, Co. Roscommon (RM11). Source: Amended from Lynch 2006; Gillespie 2001; Hurley and Hanley 2013 and Gillespie and Kerrigan 2010.

Figure 6.10. Timber-lined water trough at Sonnagh IV, Co. Mayo. Source: Richard Gillespie for Mayo County Council and Transport Infrastructure Ireland.

of earth ovens or steaming pits with fired-in-situ heating elements. In contrast, the absence of evidence for in situ fires may be indicative of charcoal-less earth ovens, steaming pits, and stone-boiling pits where hot stones were transported from adjacent hearths (Thoms 2008: 456).

Water-boiling troughs

These receptacles are generally sunken pits, usually located adjacent to hearths and often lined with stone or timber. As discussed in Chapter 5, the current study indicates that 1482 pit features out of a total of 3271 excavated in Irish burnt mounds in 1950–2010 can be interpreted as water troughs. Almost half (48%) are rectangular in plan. Seven different lining methods have been observed including stone, planking, roundwood, wattle, clay, hollowed-out logs or a combination of these materials (Figure 6.10). A further 298 pits exhibit stake-holes, cutting the base and sides suggesting the presence of a former organic lining that no longer survives. A total of 814 trough pits are unlined, however the use of an organic lining cannot be excluded in many of these examples. Poor preservation make it difficult to quantify the frequency of wooden troughs, but this does seem to have been the most common material used.

Twelve excavated sites have evidence for internal trough divisions or two compartments, possibly used to separate materials from the fired stone during the boiling process. (Figure 6.9). This was the case at sites such as Coolderry 2, Co. Tipperary (TY35), Ballycroghan, Co. Down (DN01), Dromnevane, Co. Kerry (KY21a), Gortaroe, Co. Mayo (MO27), and Currinah, Co. Roscommon (RM11). These divisions have been noted in different trough forms composed of wattle, timber planks or stone slabs. The evidence suggests that water filled both compartments, thus ruling out a connection with dry heat processes such as roasting. It is apparent that these trough divisions were significant in functional terms. One interpretation is that these divisions were constructed to separate hot stones and other debris from food cooked in the trough. For instance, at Gortaroe, Co. Mayo (MO27), a wattle partition marked the divide between the stone and peaty fills of the trough, and between the preserved wood and the half with very little wood (Gillespie 2001). There was also an obvious difference in the two fills of a stone-lined partitioned trough at Aughinida, Co. Cork (CO44) (Larsson 2003). A stone-lined trough at Tanwick in Shetland also displayed evidence of being divided. The excavators suggest that the secondary sub-compartment would ‘not only have reduced the volume of water to be heated, but may also have served to separate fragile items, such as pots or foodstuff, from the mass of hot stone within the main area of the tank’ (Moore and Wilson 1999: 213). Therefore, the compartment may have functioned as a separate cooking facility for ceramic vessels. This is suggested from the pottery analysis, which showed damage consistent with immersion in hot water (*ibid.*: 213). Although possibly connected with other activities, these divisions may have separated the accumulating hot stone from meat produce and other debris, making it easier to extract the cooked food.

Experiments have shown that where stones are re-used in a single boiling episode it is often difficult to remove those examples that have lost their heat once the meat is placed in the trough. By separating stones from the meat, but allowing hot water to flow between the two compartments, this would permit the user to extract the cooked produce with ease without the need to remove a large amount of shattered stone. The troughs as Carraun, Co. Galway (GY17) and Gortaroe II, Co. Mayo (MO31) only retained half of their timber linings, suggesting either an internal division or the loss of rest of the lining. While no definitive internal partition was noted, the lined sections may have been used to contain the hot stones in the pit allowing for easier extraction, while the unlined section may have held the meat produce. At Oldcourt, Co. Dublin (DN17), a deeper portion of the trough was interpreted as a possible means to separate food from the hot stones (Larsson 2008).

While water was heated in unlined pits, the addition of a timber or stone lining allowed for a more efficient way of water-boiling, in that it maintained the pit structure in wet ground conditions and facilitated regular emptying of heat-shattered stone from the trough. The use of moss as bedding layers under plank bases may have also allowed the filtering of water tainted by surrounding boggy environments. Water channels are also associated with troughs and some of these functioned as overflow drainage features. A number of troughs have been identified with accompanying pits at lower levels connected by short channels. These may have functioned as emptying receptacles, allowing standing or sullied water to be released from the pit and replenished with fresh water (Cleary and Hawkes 2014). The placement of some troughs over and adjacent to natural springs would seem to indicate a preference for clean water within the trough, which required some degree of planning in the siting of these pits.

Dry roasting and steaming pits

Pits are the most common feature in excavated burnt mounds and are often found in great numbers. While lined pits were used for water-boiling, smaller unlined examples associated with small deposits of burnt stone seem to have been connected to a different process involving dry heat. Pits cut into sandy soil in some sites made water-boiling impossible without the use of a watertight lining.

The interpretation of such pits is complicated by the fact they were not in use at the same time and may have been used at different times during the life of a site. The majority (70%) are circular or oval in plan. A total of 73 (4%) pits display evidence of burning/oxidisation at the base or are lined with stone suggesting they may have functioned as primitive ovens or roasting pits where the method employed in situ firing. Other pits may have used an external fire to heat the stones. This type of cooking

may have involved an unlined pit in which hot stones are evenly distributed and covered by a layer of plant material that served as a base for the food produce. Additional layers of hot stones and plant material were then added, depending on the amount of food being cooked, before being covered by earth. A fire may also have been lit on the surface of the covered pit, depending again on the food type.

Steaming pits would have functioned in a similar manner to earth ovens, the only difference being a small hole in the earthen lid made by a small stick inserted into the pit prior to its filling. As the pit was covered over, the stick was removed. Water was then poured through the small aperture, which was sealed promptly to insure that steam and vapour did not escape. Thoms (2008; 2009) has written extensively on the use of hot rocks in western North America, including processes whereby prolonged cooking was used to hydrolyse inulin-rich roots and to detoxify plant foods, to render them more readily digestible and nutritious.

6.5 Experimentation

The use of pyrolithic technology can be considered by conducting experiments to examine the application of cooking at these sites (Figure 6.11-13). This may provide a basis for the interpretation of archaeological remains representative of different cooking facilities. For example, useful data on how such pits functioned at burnt mounds can be obtained from the analysis of burnt stone (Jackson 1998; Gose 2000; Thoms 2007; 2008; Dumarçay *et al.* 2008). Thermal-weathering studies can provide information on how certain heat-affected stones may have been used. It is suggested that rapid cooling (associated with water-boiling) causes more damage to a stone than prolonged exposure to heat (associated with a roasting oven). The latter was thought to cause less damage because it slowly returned a hot, expanded rock to its original form. It was therefore concluded that large rocks (larger than 10cm in diameter) were preferred in earth ovens and rock griddles because they stored heat for longer periods of time (Shalk and Meatte 1988; Taggart 1981). Small rocks (less than 10cm in diameter) were avoided in this cooking method because they had a higher ratio of surface area to mass, which caused them to lose heat more rapidly than larger stones (Jackson 1998). Therefore, it was argued that small rocks were preferred for stone boiling because of better resistance to thermal shock and because they were easier to handle. Based on his own experiments, Jackson argues that 'the length of time of exposure to high temperatures is more important to thermal weathering than is shock cooling' (1998: 95). For him, the length of heat exposure rather than the rate of cooling causes the highest magnitude of thermal stress to a stone.

The dominance of sandstone in many burnt mounds is significant in this regard. Mandel (2007) observed that coarse-grained rock types are better in terms of the absorption and discharge of heat, whereas fine-grained rock types do not absorb heat in the same manner. The temperature of the fire would also vary depending on fuel used (hardwood versus softwood charcoal), as would the reaction of certain rocks to the heat and hot water. The selection of this material highlights the attention given to different petrologies in terms of their thermal properties for the purpose of water-boiling. As observed by Jackson, the type of stone used is important because its strength will determine the response of a rock to the various types of cooking and heating facilities (1998: 95). Based on practical experience, rocks were selected for durability and for their response to specific requirements.

Ó Néill suggested that it may be possible to establish a direct relationship between the temperature of the fire in which the stones are heated, and the volume of the stone required to heat water to cook the meat (2009: 67). In his pioneering experiment, O'Kelly (1954) demonstrated that it took 35 minutes to bring 454 litres of water to the boil, and three hours and 40 minutes to cook a 4.5kg leg of lamb wrapped in straw. The volume of broken stone produced was measured and found to be 0.5m^3. Ó Néill suggested that at Ballyvourney, the total heat transfer required to cook meat was probably around 280°C, assuming that the hearth reached temperatures of around 600°C. He also acknowledged that this is not particularly helpful for discriminating between particular thermal regimes. While there is a known rate of increase of rock temperatures and water/stone ratio, the thermal output from surface hearths with variable fuel makes a direct correlation between the volume of stone used, and pit capacities quite complex. An unknown factor in this analysis is the degree to which the stone deposit in the trough is representative of the final use of the pit as the majority of trough deposits have been disturbed by later agriculture. The majority of trough deposits are likely to present post-abandonment mound slippage from weathering, animal disturbance or natural processes. It is also difficult to establish how much of the trough was emptied after its final use. Once immersed in water, the stones required between five and ten minutes to transfer all their heat to the water. O'Kelly noted that once these stones had lost their heat, they could easily be extracted, re-heated and re-used.

6.6 The social context of pyrolithic cooking in prehistoric Ireland

The function of burnt mounds need not necessarily be seen solely in terms of the practical use of these sites for cooking (Anthony 2003: 67). Two sites may have the same primary use (cooking) but served different purposes (communal and family feasting) within the community. It must also be remembered that cooking in this manner may also have been undertaken as part of competitive display to impress other groups, as opposed to being used solely within a community (Hayden 2001: 46). It is easy to understand how this could occur in the case of weddings, etc. These social contexts, along with the socialising component of these gatherings, should not be overlooked in relation to discussions of site function. Food would

Figure 6.11. Cooking meat parcels in water-boiling trough. Source: Irish National Heritage Park, Ferrycarrig, Co. Wexford.

Figure 6.12. Cooking meat parcels in water-boiling trough. Source: Alan Hawkes.

Figure 6.13. Cooking meat parcels using the pyrolithic water-boiling technique at Doolin, Co. Clare. Experimentations carried out by Joe McCooey June 2015.

have played an essential role in assemblies, as it does in social gatherings today, consumed not only for sustenance but also for pleasure and the maintenance of social relations (Milner 2005: 59). The sharing of food is also a social act that creates and maintains different bonds and obligations within a group or community. Social groups select foodstuffs and organize meals in accordance with cultural norms and the process may involve historically determined social patterns, such as how the food is prepared. The considerable social investment required for pyrolithic cooking provides a backdrop for social activity where 'networks of personal relationships are created and maintained and social bonds are constructed and expressed' (Jimenéz and Montón-Subías 2011: 1).

In this respect, the laborious nature of the process (at least to the modern observer) suggests that cooking food in this manner may have been largely social, connected to special events and feasting. A crude comparison can be made with the modern domestic barbeque, where the cooking of food is a special event of a largely social nature. A review of various experimental work, and the historical and ethnographic evidence for similar practices provides an insight into the practice requirements and logistics of undertaking pryolithic processes. This amounts to:

• Preparing a boiling apparatus (including lining if required)

• Collecting firewood and suitable stones

• Preparation of raw food

• The lighting of fires and heating of stones

• Heat transfer process and the maintenance of fire and water temperatures.

Ó Néill observed that in total, this can represent anything from three to four hours to as many as seven or eight hours or more, depending on the anticipated result (2009: 197). This is a substantial amount of time for an activity that seems to have been undertaken on a sporadic basis. In that sense, burnt mounds may have represented significant places in which people engaged in different forms of social reproduction and the transfer of knowledge (*ibid.*).

Pyrolithic activity areas were open-air sites that were mostly unenclosed, leaving the boundaries between house and communal space where burnt mounds were typically located relatively unstructured. As Cleary has outlined, 'there are less obvious ways in which settlements can be spatially organised, e.g. through the location of external hearths and pits…which may have been equally important in creating social spaces where people came together to meet, undertake specific tasks and deposit particular artefacts' (Cleary 2007: 288) The use of external hearths as the foci for social activities within habitation areas could also be expanded to include pyrolithic sites, which are frequently found in the environs of settlements. Their exclusive occurrence in specific areas within the settled landscape suggests a clear separation where particular places used for this purpose created socially distinctive spaces (see Chapter 7). As mentioned previously, the reuse and re-lining of individual troughs shows that the locations of these sites were a fixed and permanent element in the landscape, even if the activity at each site was episodic. In a few cases it may be that localised fluctuations in water-table levels dictated the use pattern, but mostly these sites functioned as a collective facility to be used as required in different social contexts.

Grogan suggests that the sheer numbers of burnt mounds indicate that they operated at a communal and possibly even a familial social scale, while their size suggests that they were the focus of relatively small groups (2005; 2007). In relation to cooking, they may have provided a context for gatherings of kin and neighbours to prepare and share food as part of a regular social round, probably on special days and occasions that engendered bonding within local communities, outside the formality of other ceremonies and rituals that may have also taken place at these sites (see below). Wright (2000: 111) suggests that storage and food preparation were highly visible activities that created opportunities for social contacts between household and village, with the possibility that some facilities may have been shared by several groups. It has been suggested that food preparation at some Neolithic domestic sites was a process that took places outside houses, indicating that the preparation and disposal of food were highly visible activities (McClatchie 2011: 176). This may now be connected to the use of burnt mounds, excavated examples of which arenow dated to the Neolithic (Hawkes 2014).

In general terms, burnt mounds were highly visible, public spaces, where the activities concerned with pyrolithic technology posed opportunities for social contacts between different households (Figure 6.14). As such, participation in the production at burnt mounds may have provided an opportunity for neighbouring groups to establish and maintain shared values and practices, with some of the products used as gifts that helped strengthen these relationships. Food customs can be used to legitimise, undermine, or manipulate social or political hierarchies, and so it is likely that the use of these sites provided a context for the enactment and re-assertion of different roles in contemporary society (Wright 2000).

How was this food organised spatially and socially, between household and community? Which resources and activities were shared and which were private? As such, a contrast needs to be made between the two different scales of consumption: the smaller-scale domestic 'meal' and the possibility of larger-scale communal or ceremonial 'feasts' (Jones 2002: 132). The feast is seen as being less frequent, taken outside the home base at some significant location, and following its own distinctive rules in relation to such matters as food choice (*ibid*.: 132; see below). Cooking and food consumption inside the home may have expressed some sort of sociability and hospitality whereas

sharing food in outdoor arenas such as burnt mounds may have created and sustained a groups sense of community. Related to this, is site classification and the variability noted in recent years (see Chapter 4). There is a clear distinction between the heating of water and dry roasting as once-off episodes leaving perhaps solitary pits with no related spread of burnt stone, and the formalisation of such a sites as a mound or 'monument' that is intentionally defined, used and re-visited. Additional features identified in recent years suggest the technology was used in a number of different ways other than the widespread practice of water-boiling. Understanding the type of cooking depends on an ability to differentiate between different types of heating process, such as heat transfer by moisture where the heat is transferred through water, and dry heat where the heat is transferred through the air, as in an earth oven or roasting pit. As a result, a case can be made for occupation of sites over longer periods forming mounds, while smaller sites left less significant deposits. This indicates that a number of distinctions can be made in relation to the site-type as a whole (Chapter 4).

A number of sites are composed of smaller deposits of fired-stone and charcoal, with an accompanying pit (s) used for either water-boiling, steaming or dry-roasting. Other sites simply comprise isolated pits filled with deposits of burnt stone and charcoal, also indicative of pyrolithic processes, but without substantial deposits of waste material. It has been demonstrated elsewhere that pits of this nature were used as ovens or roasting pits relating to dry heat without the substantial use of water (see below). Similar sites have been found in Britain along recent road, pipeline and other development schemes (Maynard 2012; Flook and Kenney 2008) As such, these features have not been widely discussed as separate distinct entities in Britain and Ireland, with many simply classed as 'burnt mound' or 'pot-boiler'. These site types do not represent the same level of communal social investment as other burnt mounds, but are still located in areas of persistent burnt mound activity where more sustained pyrolithic water-boiling and related processes took place. These lesser sites, employing the same technology must relate to less intensive use compared to the larger burnt mounds. This was the case at sites such as Coolfin 4, Co. Laois and Ardbraccan, Co. Meath (LS29 and MH65) where the remains of well-defined troughs were found, with evidence of timber linings and no related mounds. At other sites where this social investment was not undertaken, small unlined pits were used for short-term boiling/roasting/steaming. This may imply that the size and lining of a trough pit partly depended on whether a particular location was deemed important enough for prolonged pyrolithic activity where sufficient resources were locally available. It is reasonable to suggest that these smaller pyrolithic sites may not have been used for larger communal based gatherings, but may instead relate to smaller familial or hunting party meals organised on an *ad hoc* basis (Murray 1995; Dietler 1990). This suggests that some tasks, including the preparation and consumption of food, were not confined to any one category of burnt mound site, but took place at many different locations in combination with more specialized activities. At some of the larger burnt

Figure 6.14. Reconstruction of a Late Bronze Age burnt mound in Anglesey, north-west Wales. Source: John Hodgson

mounds, it is conceivable that the archaeological remains represent places that people regularly returned to over a long period of time. They could represent the remains of a single family usage at a given time or a larger community, though it is important to stress the limitations of the data-set in this regard.

By the Middle Bronze Age functionally and spatially distinct domestic sites were a common feature of the settled landscape. The widespread use of pyrolithic technology would imply that burnt mounds were an integral part of this settlement pattern. The location of many burnt mounds within these settlement locales, some immediately adjacent to habitations, might question their significance as communal feasting places (Moore and Wilson 1999; Parker Pearson 2005). Some may have operated on a small scale, where family groups prepared and shared food as part of a regular social round. However, as outlined by Toolis (2005) in relation to a burnt mound on Sanday in the Scottish Isles, small landholding groups may not have had sufficient resources to produce meat for consumption on a frequent basis. The provision of communal feasts by different landholding units at different times, may have offered members of the wider community the opportunity to consume meat on a more frequent basis than each individual landholding unit was capable of. This would have maintained social cohesion through reciprocal relationships between individual groups within the wider community. This may explain the deliberate planning and careful construction of some sites with stone built hearths and large, lined troughs with substantial structural coverings (Figure 6.15). Examples such as Scartbarry, Co. Cork, Carrignafoy, Co. Cork, Cloughjordan, Co. Tipperary, and Coolmoohan, Co. Cork, might have provided appropriate settings for communal feasts given the size of the water-boiling troughs capable of cooking large amounts of food during a single event (O'Brien 2012b). The communal aspect of feasting is further supported by the spatial association of many burnt mounds with stone circles and other ritual monuments in later periods of the Bronze Age (Fahy 1960; Murphy 2009; Hogan 2009; Grogan 2005; Cleary and Hawkes 2014). This suggests that the familial, 'domestic', 'communal' and 'ceremonial' use of the technology was not mutually exclusive and all operated concurrently. These specialised structures should also at least in part be attributed to the cost of hosting competitive display feasts. Consumption of high cost animals, lavish displays or deliberate deposition of particular objects are the hallmarks of competitive displays (Hayden 2011: 46). In addition to these unusual structures, there is also the possibility that a number of dry-walled structures of the Middle to Late Bronze Age in some upland areas of the country were constructed for similar cooking activities (O'Brien 2009). A site at Garranes, in the Beara Peninsula, Co. Cork, provided evidence for two separate phases of activity, beginning with a typical burnt mound using the hot-stone/water-boiling technique (Figure 5.2). This was replaced when a possible roofed structure was constructed over the site for use as a cooking house for dry roasting (O'Brien 2012a). The site provided clear evidence for a change in cooking methods during the Late Bronze Age, and can be compared to other examples with troughs that indicate a change from water-boiling to dry roasting in later periods (see Chapter 5).

The production of steam may have led to new applications of pyrolithic technology during the later part of the Middle Bronze Age. While water-boiling, and to a lesser extent dry roasting, remained important throughout the second millennium BC, the use of the technology for the creation of steam may have been limited to certain elements of society (Gleeson 2004; Eogan 2007). This evidence is very limited but a range of distinguishing characteristics may be tentatively identified. These include the presence of a large circular pit, *c*.5m in diameter, with internal stake-holes indicating the presence of a tented structure. Examples include Rathpatrick, Co. Kilkenny (KK19), Ballykeoghan, Co. Kilkenny (KK49) and Burrow and Glennanummer, Co. Offaly (OY08), sites that have been interpreted as the remains of sweatlodges where water was poured on hot stones to create steam inside small tented structures. Given the rarity of such sites in the archaeological record these facilities may have been used for special purposes throughout the year, possibly for ritual cleansing that had a seasonal aspect. The social aspect of the steam lodge is also important and may have been a focus for gathering of specific groups at periods during the year. This is significant in terms of our wider understanding of the use of pyrolithic technology in prehistoric Ireland.

In conclusion, the considerable social investment required for pyrolithic cooking provides a backdrop for social activity where 'networks of personal relationships are created and maintained and social bonds are constructed and expressed' (Jiménez *et al.* 2011: 1). When food was being prepared, burnt mound locations would have provided a familial background for other everyday tasks. This is supported by the recovery from excavated burnt mounds in Ireland of fifteen saddle querns and a number of stone discs and spindle whorls, along with considerable amounts of flint and chert debitage. As with modern mealtimes, cooking activity was probably undertaken at regular times during a working day. At a broader temporal scale, 'special meals or feasts may mark periodic events in the yearly cycle' (Milner 2006: 70). Distinctive smells, perhaps of burning of certain woods, as well as various foodstuffs emitting smoky fumes enliven a sense of atmosphere that may have been heightened by the incorporation of musical elements to the site. The discovery of wooden (yew) musical pipes from the base of a timber-lined trough at Charlesland, Co. Wicklow (WW22), dating to the Chalcolithic/Early Bronze Age period (2137–1909 BC), is notable (Molloy 2003). Before exploring the possible use of these sites as feasting areas, it is necessary to discuss the evidence for other possible uses besides cooking.

6.7 OTHER DOMESTIC USES AND SOCIAL GATHERINGS

Bathing, whether domestic or ritual, is an explanation supported by both literature and anthropological parallels.

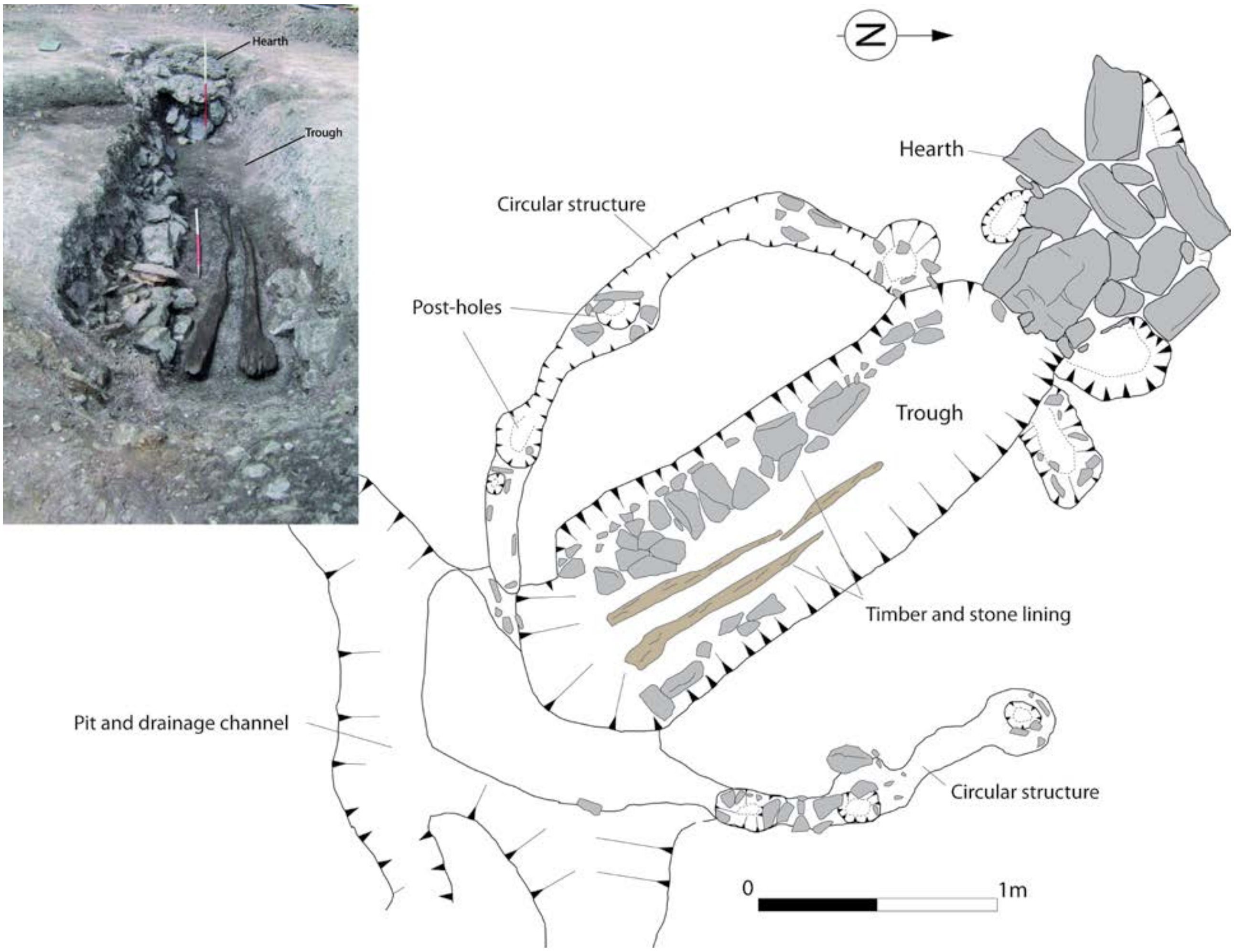

Figure 6.15. Plan of excavated features at Carrignafoy, near Cobh, Co. Cork. Inset, stone and timber lined trough. Source: Redrawn from Ní Loingsigh 2007 (Sheila Lane and Associates).

Lucas (1965: 78) compiled an impressive corpus of documentary references to bathing customs in early Ireland and observed that 'the general impression left by such evidence as exists is that bathing was a normal part of the routine of personal hygiene, at least among the upper classes whose habits are reflected in the literature' (*ibid.*: 78). He observes that the bath was thought of as a means of refreshment because much of the literature is of a heroic nature and this aspect of bathing is usually connected with battle weary warriors. The most famous account is to be found in the seventeenth-century text by Geoffrey Keatings *Foras Feasa ar Éirinn*, which describes the Fianna warriors using these pits for cooking and bathing: 'As to the Fian..each of them stripped off, and tied his shirt around his waist; and they ranged themselves around the second pit...bathing their hair and washing their limbs, and removing their sweat, and then exercising their joints and muscles, thus ridding themselves of their fatigue' (Dineen 1908; Ó Drisceoil 1988). Similar accounts are found in the *Romance of Mis and Dubh Ruis,* where the fat from deer meat, boiled in water is used as a rubbing agent to massage the body in a cold water pit (Lucas 1965; Ó Drisceoil 1980). Various texts also refer to the role of ceremonial baths during the inauguration of royalty such as those of the *Uí Fiachrach* and the *Cenel Conaill* (Newman 2002: 116).

As previously discussed, the problem with these literary sources is they are much later than excavated burnt mounds dated by the radiocarbon method. Ó Drisceoil (1990: 157) observed that 'it would be wrong to uncritically accept the early Irish literary evidence in an interpretation of the cultural, social and economic contexts of burnt mounds, in dating them, and in ascribing a function to them'. He argued that a clear distinction needs to be made between the type of bathing that is being suggested, either cleansing by sweating or cleansing by hot water (Ó Drisceoil 1988: 677). Furthermore, he observed that open-air bathing in a water trough would be made very uncomfortable, if not dangerous by the presence of quantities of hot broken stone on the floor of the trough (*ibid.*: 679). It was also argued that the small size of most excavated troughs made bathing by total/partial body immersion highly unlikely. Experimental reconstructions have also shown that the heating processes requires a great deal of stone to be transported to the trough, therefore it may have been necessary to partially empty the trough of stone prior to bathing.

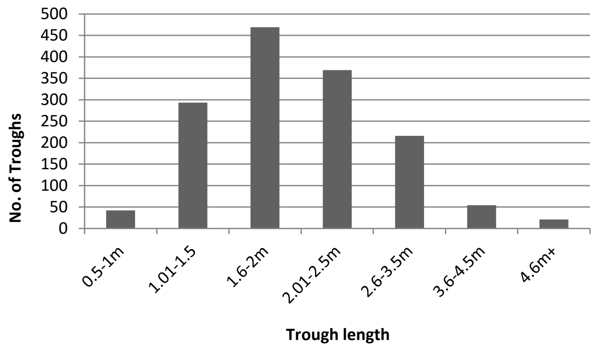

FIGURE 6.16. RANGE OF TROUGH LENGTHS AT EXCAVATED BURNT MOUNDS IN IRELAND

Recent evidence has re-opened these debates, due to large size of some excavated troughs and the possibility that others were roofed within enclosed structures. It can now be established that the average size of most excavated troughs (*c.* 2.4m (L) by 1.4m (W)) would allow sufficient space for single person immersion, with 343 excavated troughs greater than 2.5m in length (Figure 6.16). Troughs exceeded 4m in length would allow a number of people to bath at any given time. Ó Néill (2009: 188) observed that the most significant indicator of function is the thermal regime employed during the heating process, as the intended product may require water to be heated to various temperatures, at varying speeds, and maintained at particular temperatures to facilitate certain goals. Therefore, if bathing was intended, the water may not have been boiled, but rather heated to a required temperature, negating the build-up of large quantities of hot stones in the trough. As the water was boiled, the stones could be easily removed by hand once they had lost their heat. If this was a secondary process however, as argued by Ó Drisceoil (1988), then the fired debris may have removed from the water trough after its initial purpose was fulfilled and re-used for bathing. Alternatively, the lower pits adjacent to a number of boiling troughs may have been used to drain hot water from the higher trough and released to the lower pit for bathing, free from shattered stone (see Chapter 4). The associated sluice systems may also have been used to filter the sullied water from the trough above. This may have been the case at Carrigtohill, Co. Cork (CO79; Figure 6.17), Clonymeath, Co. Meath (MH14) and Ask, Co. Wexford (WX05).

It has been argued that some larger pits identified at these sites may have functioned as primitive, open-air baths or enclosed bath houses (Roycroft 2008; Grogan *et al.* 2007; Hackett 2009d). These interpretations, however, are unlikely due to the relative depths of these pits and the volume of stone needed to heat the water. Furthermore, the majority fill naturally with water making regular emptying of fired debris almost impossible. For example, large pits revealed at Clogh East and Commons Little, Co. Limerick (LK39 and LK42) were disregarded as pits for heating purposes due to their substantial depths (Grogan *et al.* 2007: 95). There is also no evidence to indicate that these large pits were roofed making it more likely they functioned as water sources for adjacent troughs. A well-preserved site at Annaholty, Co. Tipperary (TY45), contained a rectangular trough lined with wood, stone and clay. A wooden platform, held in place by wooden pegs, and a clay and stone-lined well at the north-eastern end, were shown to be contemporary features (O'Neill 2010). The site was interpreted as an open-air bathing area due to the immediate landscape being extremely waterlogged, negating the need for an associated well (*ibid*.: 39). However, it is likely that the hydrology of the site may have changed significantly since the Bronze Age. This is supported by the construction of a clay-lined trough, implying that it would have required manual filling from the adjacent well. Clean water was also important for the intended purpose and in that respect the site can be compared to others that have wells, such as Baloo, Co. Down (DW10) and Ballinglanna North, Co. Cork (CO71).

The suggestion that burnt mounds may represent sites of prehistoric saunas gained considerable interest in the late 1980s following the publication of an article dealing with equivalent sites in the English midlands (Barfield and Hodder 1987). Such a concept represents a fundamental change, not only in the function of these sites, but also in the technology used. The objective changes from one of heating water, to the production of steam or dry heat. Rather than stones being heated and then placed in a trough, water would have been splashed on the stones for the purpose of steam production. Ó Drisceoil (1990) pointed out that the presence of a trough and the absence of roofed structures posed a major problem with regard to this hypothesis. Typically, an enclosed space is required for sweating to occur using pyrolithic technology. Different types of sweating can be suggested, including dry sweat bathing and steam bathing, similar to modern saunas. Dry sweat-bathing can involve the conduction of heat without the use of water or hot stones, similar to nineteenth-century sweathouses in Ireland (Milligan 1898; Harte 2008). These 'hot-air baths', as described by Milligan, are beehive-shaped, stone-built structures with small entrances and are known in many parts of the country. The method involved lighting a fire in an enclosed stone structure until the walls were red hot. The embers were then raked out and the person crawled in on a bed of rushes (Lucas 1965). Another method of dry sweat bathing involved the transporation of hot stones into a small enclosed space, thus radiating heat around the structure.

Alternatively, steam bathing involves the conduction of steam using a combination of hot stones. The most simple method by which this is achieved is by pouring water onto hot stones in an enclosed space. Another method is to place hot stones into a water trough located inside a covered structure, generating a constant build-up of steam in the confined space (Figure 6.18-19). In recent years, this possibility has become popular as a small number of large troughs have been excavated with evidence of substantial timber coverings/structures. It has been suggested that the larger the trough size, the greater the surface area for steam

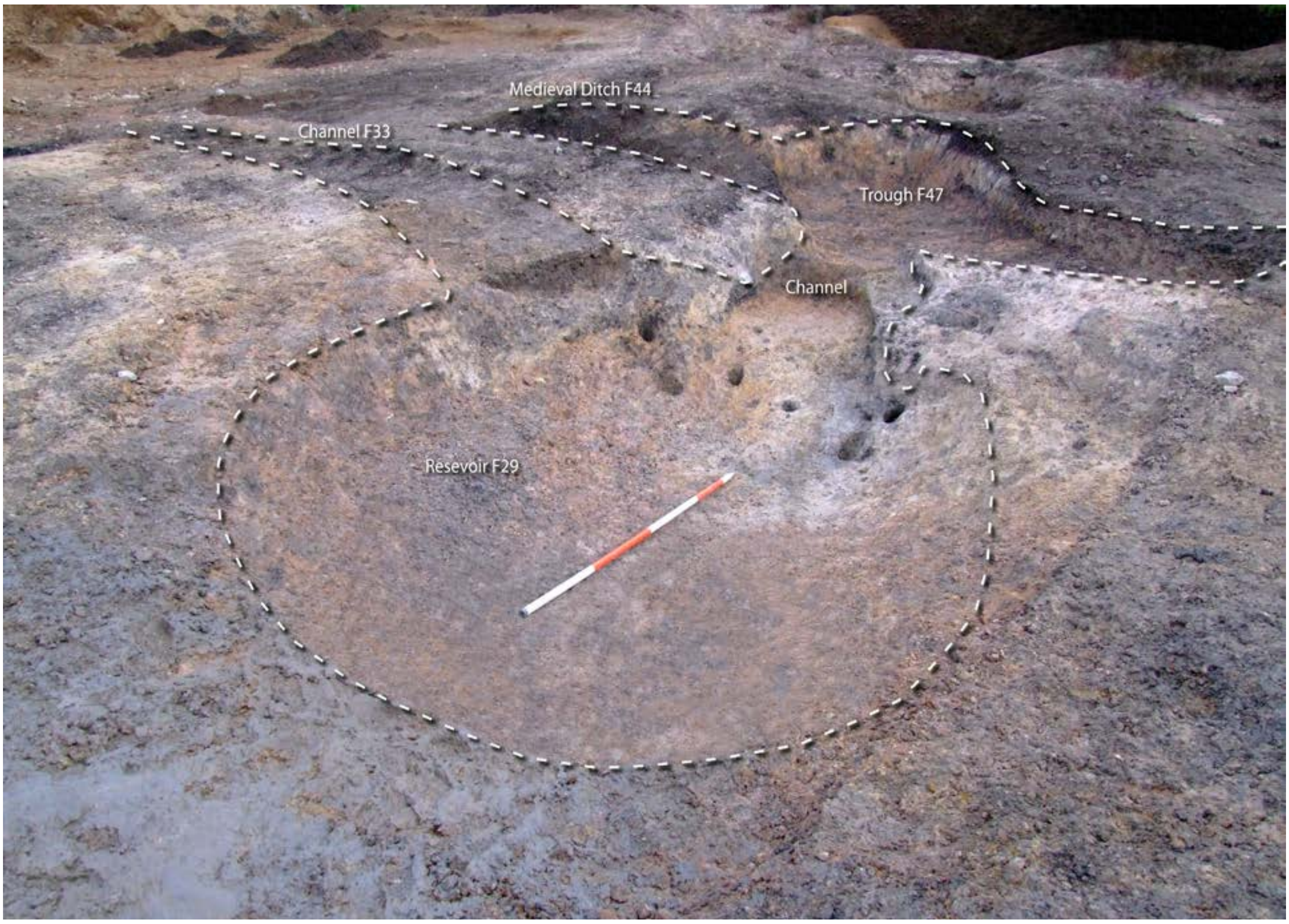

Figure 6.17. Truncated trough with associated water channel, evidence for sluice gate and lower reservoir or emptying pit at Carrigtohill, Co. Cork. Source Rose M. Cleary, UCC.

to evaporate off the water (Hanley and Hurely 2013). If the trough was filled with heated water and hides or thatch was used to roof the timber structure, high humidity levels would have been achieved (*ibid*.). As mentioned previously, these include Scartbarry 1, Co. Cork (CO54), Carrignafoy, Co. Cork (CO81), Cloughjordan, Co. Tipperary (TY65a), and Coolmoohan, Co. Cork (CO94), with the evidence in each one interpreted as a sweathouse, complete with external plunge pools (Figure 6.20). This is also suggested where stake-holes are present in the immediate vicinity of troughs indicating the possibility of a light canopy or roof (see Chapter 4).

Others (O'Brien 2012b; Ó Drisceoil 1988) have observed that this interpretation is not convincing due to one important reason. The immersion of hot stones into large troughs of cold water is not an efficient method of producing steam. However, experimentation has demonstrated that once the water is at a certain temperature a sufficient and constant supply of steam is generated from the trough, even enough to fill a small enclosed space for steam bathing. The problem with such an explanation is that it is labour intensive and a great proportion of steam is absorbed and lost through a thatch roof and under the eaves.

It has been proposed that one way in which these enclosed troughs may have functioned as sweatlodges is if hot stones from the hearth were laid out in the adjacent 'trough' trench and splashed with water (O'Brien 2013). As the troughs did not fill naturally with water, this may explain the drainage channels and associated pits connected to the troughs at Scartbarry 1, Co. Cork (CO54), Carrignafoy, Co. Cork (CO81) and Blanchvillespark Co. Kilkenny (KK35). However, if we consider the ethnographic record, substantial troughs are not required for this process, with small internal pits sufficient enough to hold and generate the required amount of steam (Lopatin 1960; Quattrin and Cremin 1988; Sullivan 2001; Groark 2005). The presence of drainage channels at some of these examples would imply that water was important and the troughs would have required manual filling.

As mentioned previously, these sites are more likely to represent roofed cooking huts, with an extra-large trough allowing the processing of greater amounts of food. While most of these sites are open-air facilities, the use of a building may have reduced heat loss and facilitated cooking in this type of elongated trough, especially in adverse weather conditions. As O'Brien (2013) observes, these sites may be another variant or even regional variant (given the numbers identified in Co. Cork) on the burnt

mound type, connected in this instance to larger output of food for feasting purposes, perhaps on ceremonial occasions. They can be compared with a small number of stone-built structures designed to carry out similar cooking using dry heat in the Late Bronze Age, such as those identified at Drombeg, Co. Cork (CO07), Site D on the Beara Peninsula, Co. Cork, Garranes, Co. Cork (CO57), and possibly Coarhamore, Co. Kerry (Fahy 1960; W.O'Brien 2009; 2012a; Hayden 1994).

It has been suggested, however, that roofed boiling troughs would have been impractical for cooking as the steam produced would have made it almost impossible to function, eventually becoming a steam bath by default (Armit and Braby 2002: 254). The same may apply to examples in Scottish Isles (see Chapter 3). While this is a possibility, experimentation has shown that the steam produced during this processed often escapes through the roof, eaves and doorway and temperatures are not intolerable to allow cooking to take place. However, it may have allowed opportunistic steam-bathing to occur during the cooking process. It is also unlikely that these structures functioned as smoke houses for the preservation of meat, as the presence of troughs and drainage channels implies that water played a significant role in their use. Charred wood chips should also be present from the excavated sites. The production of steam would negate their role as smoking houses for preservation while the utilisation of salt in prehistoric Ireland is absent from the archaeological record.

More convincing evidence in relation to the use of some sites at sweatlodges/saunas is provided by what appears to be a genuine example excavated at Rathpatrick, Co. Kilkenny (KK19) (Gleeson *et al.* 2004; Eogan 2007; Eogan and Shee Twohig 2011). The site contained a large circular pit, 5m in diameter which was internally surrounded by stake-holes suggesting a light tented structure. It had an adjacent hearth, internal pit/oven and an external plunge pool that was connected to the structure by a series of steps. Hot stones appear to have been placed into a dry pit and splashed with water, generating steam within the covered structure. Somewhat similar sites were discovered at Ballykeoghan, Co. Kilkenny (KK65) and Burrow and Glennanummer, Co. Offaly (OY08), which are both interpreted as sweatlodges (Laidlaw 2008; Coughlan 2009). The latter example, however, may have involved bathing, as it was linked to a number of water-troughs. An unusual rectangular example was uncovered at Blanchvillespark, Co. Kilkenny (KK35), which consisted of a plank-walled structure contained within a shallow depression, measuring 4m by 2m, with a small annex. An internal pit and drainage gully led to an external pond. An external hearth was also identified, 2m to the east of the structure and all features were overlain with burnt mound material (Coughlan and Bailey 2011). A somewhat similar example was identified at Richmond/Gortladore Co. Tipperary (TY24) (Murphy and Clarke 2000). While the design of these potential sweatlodges can vary, all are semi-subterranean or at least set within pits or shallow depressions similar to structures used for communal steam-bathing throughout aboriginal North America (McDonald 1992; McDonald and Williamson 2001).

Not all forms of sweatlodge may have involved the use of steam. The process identified at Rath, Co. Meath (MH25) is substantially different to that recorded in the previous examples, as one of the structures there may have involved another variant of the sweat-bathing process. The excavator interpreted two structures as possible 'steam-lodges' involving the use of pyrolithic technology. The earliest is a Bronze Age example consisting of three successive circular stake-hole structures with an internal pit and a beaten earth surface. An external hearth was also identified along with several other stake-hole clusters. The internal pit contained burnt mound material and it was suggested it may have held hot stone on which water was sprinkled to produce steam within the structure. An adjacent structure is dated to the Iron Age *c.*370−110 BC (WK-17942) and consisted of a rectangular area defined by large post-holes and an external hearth and trough. The evidence suggested that the hearth had a clay dome and was linked to the structure via a flue or channel measuring 3m in length, which led downslope into the 'steam-lodge' (Schweitzer 2009). The excavator suggests this flue may have provided the structure with hot water, though that seems unlikely given the direct association with a hearth or 'furnace' (*ibid.*: 31). More plausible is an association with dry heat, where hot air flowed from the hearth/fire-box through the channel and into the structure, similar to preclassical Maya sweatbaths (Hammond and Bauer 2001) and those described in Scotland (Armit and Braby 2002; Marshall *et al.* 1998). A sequence of metalled terraces were also noted on the south side of this structure to access an adjacent canalised stream possibly used for cold plunging after sweat-bathing. At the Rath site, there may be evidence for a change from steam-bathing at the earlier Bronze Age structure to dry sweat-bathing during the Middle Iron Age. A similar scenario was identified at a two phased stone structure at Ceann nan Clachan, North Uist Scotland (see Chapter 3). Comparisons can also be made with changes in pyrolithic cooking methods in some sites after periods of abandonment. The identification of possible sweatlodges not only adds a new site type to the catalogue of late prehistoric monuments in Ireland, but suggests that pyrolithic technology may have had a more complex use than cooking. In recent years, somewhat confused definition of sweating was assigned to sites with different structural evidence, with little discussion as to how this process was carried out. A review of the evidence now suggests two forms of possible sauna in prehistoric Ireland: dry-heat saunas and steam-lodges with only the latter using pyrolithic technology. As such, they should not be referred to as burnt mounds due to the absence of water-boiling activity. Given the impracticalities of producing steam from boiling troughs at Type 6 sites (see Chapter 4), these are unlikely to have functioned as steam-lodges, instead used as possible bath houses or cooking huts.

Figure 6.18. Transporting hot stones into reconstructed sweatlodge during filming of RTE's Nationwide programme 2011. Source. Alan Hawkes

Figure 6.19. Reconstructed sweatlodge or sauna (Type 6 sites) at Rathbarry, Co. Cork. Source: Alan Hawkes

Figure 6.20. Artist impression of reconstructed sweatlodge at Scartbarry, Co. Cork. Source: Ken Hanley, Transport Infrastructure Ireland.

The discovery of more plausible examples using more efficient methods of steam production would support this conclusion. These consist of structures whereby stones were placed internally within small pits and sprinkled with water to produce steam. Small channels associated with these pits such as those identified at Rathpatrick and Blanchvillespark may have carried condensed water out of the structure similar to an example identified at Ceann Nan Clachan, North Uist, Scotland (Armit and Braby 2002). Dry saunas, on the other hand, are more difficult to identify, however an example at Rath, Co. Meath, may have functioned as such, channeling heat from an outside hearth into the structure. It is possible that some stone structures of Bronze Age date with internal recessed hearths in Ireland and Scotland may have functioned as dry sweat-baths using direct heat from the fire to generate high temperatures. However, a separate flue/chimney should presumably be envisaged for any such reconstruction as they would simply fill with smoke. One possibility is that they functioned similar to nineteenth-century Irish examples where the fire was allowed to die down before sweating began.

At a superficial level, saunas such as these demonstrate a desire for cleanliness and hygiene in Late Bronze Age Ireland. Ethnographic sources suggest that the use of these sites in this manner was of considerable social and spiritual significance to the communities who built them (Eogan 2007; Eogan and Shee Twohig 2011). Evidence of ritual bathing in Finland and Russia suggest sweathouses are associated with rites of passage, childbirth, purification before marriage or before a funeral (Eogan 2007). A Native American tribe, the Nez Perce, also associated ritual bathing with food gathering activities such as hunting, fishing and plant gathering, suggest that such ritual bathing may have had a seasonal aspect (Bruchac 1993: 147). With these examples in mind and given their rarity in the Irish archaeological record, sweatlodges may have been used at significant times throughout the year for ritual cleansing. This is significant in terms of a wider understanding of burnt mounds and the use of pyrolithic technology because the site type can have many functions that are not always apparent from the archaeological record. For instance, the curative function of nineteenth-century stone sweathouses in Ireland are certainly not apparent from the surviving archaeological remains. It is only through contemporary writings and an oral/folk tradition that the function/purpose of such buildings are known. Therefore, possible medical or curative uses of Bronze Age sweatlodges should also be considered.

6.8 Burnt mounds as industrial and craft-working sites

The large number of burnt mounds in the Irish landscape has encouraged speculation that these sites may have had many different uses. While some individual sites may have been multi-functional, it is probable that others

had very specialised functions. In the very broad context of burnt mound function, it is worth rehearsing some of the possible uses to which these sites were put. Some of these explanations have been widely, but not exhaustively, discussed in the literature, and to some extent have influenced the assessment of burnt mounds. These include boat-building (Lane-Fox 1875), the steaming of structural timbers (Ó Néill 2009), butter production (Fenton 1976), metalworking (Fairholme 1895), brewing, leather-working (Lucas 1965; Coles 1979), horn/antler working (Danaher 2008) and the fulling/dyeing of textiles (Jeffery 1991).

Metal-working

There is no convincing archaeological evidence for the use of pyrolithic technology in early metal production in Ireland. The recovery of a small amount of metal slag and other waste can be explained by either later activity at a burnt mound or as a result of natural processes misinterpreted as metalworking waste. The latter would include the heat-fused fragments of natural iron pan from Castlebellingham, Co. Louth (Buckley *et al.* 1987). This has generally been resolved by scientific dating which places all of these sites with so-called iron working waste firmly in the Bronze Age.

Metal slag connected to iron production has been recovered from Buntalloon, Co. Kerry (KY05), Rathmore, Co. Wicklow (WW07), Scrahane, Co. Waterford (WD10), Ballycorick, Co. Clare (CE12), Caherweelder, Co. Galway (GY25), Newtown, Co. Westmeath (WM17), Ballyman, Co. Dublin (DN01), Cahiracon, Co. Clare (CE21), Tullahedy, Co. Tipperary (TY27), and Crabbsland, Co. Limerick (LK19). Iron-rich deposits and ferrous material were identified at Coolroe, Co. Mayo (MO12) and Greenan, Co. Waterford (WD29). All of this material can be interpreted as intrusive material related to medieval metal-working activity on the site or nearby. Some ferrous material may also be natural bog ore from the waterlogged/podzolised soils at these burnt mound locations.

At Killaspy B, Co. Kilkenny (KK13), Crabbsland, Co. Limerick (LK19), Tullahedy, Co. Tipperary (TY27), and Ballyman Co. Dublin (DN01), the evidence points to opportunistic use of earlier burnt stone surfaces in waterlogged areas for metalworking, whereas at Parksgrove, Co. Kilkenny (KK06) and Scrahane, Co. Waterford (WD10), the material can be explained by the presence of iron-working sites adjacent to earlier burnt mounds. This may be the case at Rathmore, Co. Wicklow (WW07), which produced evidence for on-site metalworking in the form of metal slag recovered from a large pit. This could also account for some medieval radiocarbon dates obtained from these sites, previously interpreted as evidence for an historical burnt mound tradition (Hawkes 2012). At Groin, Co. Kerry (KY08), the excavator suggested that one of the troughs was re-cut at a later period and re-used for smelting metal (Dennehy 2008). In other cases, such as at Greenan, Co. Waterford (WD29), Coolroe, Co. Mayo (MO12) and Caherweelder, Co. Galway (GY25) the material is interpreted as natural in origin.

The choice of similar locations for these activities may be explained in part by the large-scale use of charcoal fuel in early iron production. Large quantities of wood are also essential for hot-stone processes, which may explain the similar location of the two site types. Such processes would have been located some distance from the main settlement, as they posed a serious fire risk to any timber structures and created large amounts of smoke (Kelly 2000: 369). Burnt mounds would have provided ideal dry locations in otherwise wet environments for charcoal production and other ‘industrial’ activities in the medieval period. For example, at Cashelduff, Co. Meath, a possible Neolithic cairn was re-used for charcoal production in the medieval period (Gillespie and Kerrigan 2010: 37). Charcoal production pits have also been recognised at burnt mounds such as Shanboe 5, Co. Laois, Ballymackeamore, Co. Limerick and Garraun, Co. Tipperary (Long 2010). Comparisons have been made between burnt mounds and iron-working sites in so far as both represent small-scale episodic activity conducted over time by a nearby community (Carlin 2008: 107). In the context of burnt mounds and pyrolithic process, it is improbable that the technology was used in metal-related activities as metallurgical processes tend to leave rather clear traces in the archaeological record. None have produced considerable amounts of slag or other by-products relating to such processes and the features identified at these sites are not indicative of this industrial activity (Grogan *et al.* 2007: 99). Also, with the majority of burnt mounds dating to the Bronze Age, no evidence of copper/bronze metallurgy has been found at these sites.

Leather-working

Some elements relevant to leather working are present in the archaeological record. The raw material, animal hide, is implied by the presence of butchered animal bones of cattle, deer, sheep and pig. Scrapers for removing fat, flesh and possibly hair from the hides are present in the lithic assemblage, while one fragment of prehistoric leather was recovered from a pit at Ballybar Lower, Co. Carlow (CW10). The possibility that leather was processed using pyrolithic technology has been proposed on a number of occasions (Coles 1979; Hodder and Barfield 2003; Ó Néill 2009: 75). Coles conducted experimental work that showed how leather shields could be fashioned by stretching the leather over a mould after exposing it to a moist environment. The tanning of leather is another possibility, however it appears that the preferred method for production of leather in prehistoric Europe was curing rather than tanning (Groenman-van Waateringe *et al.* 1999). Hot water is also not required for the tanning process or curing the hide, which usually involved salting to remove excess water. Overall, there is little archaeological evidence to support the suggestion that pyrolithic technology was used in leatherworking in prehistoric Ireland.

Textile processing

Jeffrey (1991) proposed that some burnt mound sites may have been used for the dyeing or fulling of textiles, an interpretation that has become popular in recent years (Reilly and Brown 2013). Fulling is essentially the art of cleansing, shrinking and thickening cloth and requires both warm and cold water as well as a detergent agent (*ibid.*: 97). As outlined in Chapter 2, experimentation using pyrolithic technology has confirmed that raw wool could have been fulled and also dyed at these sites using natural detergents and plant materials (Ann-Marie Denvir- www.angelfire.com/fl/burntmounds.html). This hypothesis has also been favoured where limestone has been used as a heating agent due to the caustic nature of this material when burnt. Similarly, where inter-connected pits or sequential troughs are uncovered, it has been proposed that these may indicate a production line of events in which each pit served a separate function during the fulling or dying process. Associated stake-holes are often interpreted as drying racks for the woollen garments.

Trace-element analysis has been carried out to test the hypothesis that burnt mounds could have been used for processing or laundering of textiles at Coonagh West, Co. Limerick (Reilly and Brown 2013). When all elements of the site were taken into account, namely morphology, trace-element analysis, pollen and macro plant remains, the authors hypothesised that the site may have functioned as textile processing area during the Chalcolithic. Evidence for fulling is evident from its location, adjacent to an ancient palaeochannel with a Y-shaped wooden object from the mound possibly used to support a drying frame. The unusually high levels of meadowsweet, common sorrel and alder pollen from the lower levels of the trough were interpreted as being deliberately collected and used for the dyeing process, as dyes occur naturally in these plants. Furthermore, as vegetable dyes need a mordant to fix them to the fabric, the high metal values of Pb and Zn from soil samples from the trough could have been used as an agent to bind the two together. The soil is interpreted as being derived from an area or areas with intrusive igneous rocks which have undergone mineralisation (Reilly and Brown 2013). This may be a coincidence, however, caused by the concentration of these elements in fine alluvial elements washed into the trough. Furthermore, the high levels of certain plant materials could be explained by taphonomic processes, where the trough was left open after abandonment, leaving the final trough deposit susceptible to internal overgrowth, flooding and plants growing in the immediate vicinity. This material is common in open pit features such as wells, many of which are found at burnt mounds. Fragments of animal bone were also recovered by hand from Bronze Age contexts at Coonagh West, identified as cattle, pig and red deer, while a fragment of a left human tibia was recovered during testing from the palaeochannel (Reilly 2010). This material was not considered by the authors in their interpretation of the site, with much of the environmental analysis given as evidence for textile processing.

Antler or horn-core processing

Cow horn cores were excavated from a rectangular trough and a large sub-circular pit dating to the Middle Bronze Age (1260–1010 BC) at Gortnagroagh 1, Co. Laois (LS38) (Danaher 2008). This raises the possibility that burnt mounds were used to process cattle horn, a practice usually associated with medieval sites. Antler has also been recovered at burnt mounds in Ireland, the first such discovery comes from Fahee South, Co. Clare (Ó Drisceoil 1988; see section 6.3).

Horn is a relatively soft, fibrous and flexible material (Davies 1987: 59). In the manufacture of horn items, the bony core would not have been used, but only the outer keratinous sheath, or the true horn, which would have been removed from the core. The core is then of no further use and is often classified as debris from the manufacturing of horn items when found on archaeological sites (Chaplin 1971: 142). Unfortunately, horn, unlike the core, rarely survives on archaeological sites (Davis 1987: 59). A common method of separating the inner core from the sheath was to remove the sheath in cylindrical sections, either by cutting through the entire core before separating the sheath or by simply cutting the sheath and sliding the sheath from the core once the union between them had been broken (Mainman and Rogers 1999: 1916). Another way of severing the union between the inner bony core and the outer sheath was by softening the horn through soaking or boiling the horn in water. They were then separated simply by pulling the outer sheath away, leaving the core as refuse (Chaplin 1971: 142).

During the medieval period, horn was an important commodity for making containers, combs, knife-handles and even the windows of lanterns (Davies 1987: 190). Evidence for this is rare in prehistoric contexts and it is unclear what procured horn may have been used for. It is possible that preservation may account for the paucity of horn working evidence in the Irish prehistoric archaeological record. That said, if horn working was a common craft in the prehistoric period then more cores should be found from prehistoric contexts, as these would survive better than the outer sheath. Only three burnt mounds (Moyveela, Co. Galway (GY23), Kilmessan, Co. Meath (MH35) and Clowanstown Co. Meath (MH82) have produced horn cores and all these are single finds. While the burnt mound activity at Gortnagroagh 1 tentatively provides evidence for horn working in late Middle Bronze Age, a closer inspection of excavated evidence casts doubt on this interpretation. For instance, none of the horn cores were selected for radiocarbon dating as all were lost during post excavation analysis. The dated charcoal was recovered from the upper fill of the large pit which also contained post-medieval iron objects indicating an obvious disturbed context. Iron objects were also recovered from the ditches and no burnt mound or spread was revealed. As a result, a certain degree of caution should be applied to the site in any interpretation of Bronze Age horn processing using pyrolithic technology.

The worked antler bone recovered from a number of Chalcolithic and Early Bronze Age burnt mounds may be connected to craftworking but there is no evidence that this involved pyrolithic technology. As mentioned previously, indirect cooking is a laborious process that would have required constant maintenance of a number of features, including the hearth and water temperatures. It is, therefore, not surprising to find evidence of other activities being carried out at these sites during the water-boiling process. When food was being prepared, burnt mounds would have provided a familial background for everyday tasks such as flint knapping, the spinning of wool, the processing of grain and the manufacture of bone objects. These activities may explain the presence of waste flakes, spindle whorls, saddle querns and worked antler.

Brewing

Although Redmond (1885) was the first to suggest that burnt mounds may have been used for brewing beer, Quinn and Moore (2007; 2009) have popularised this theory in recent years through experimentation (https://www.youtube.com/watch?v=dZ6K03ovxCM). They established that burnt mound sites could have been used for this purpose, with the trough used as a vat to heat a grain mash to prepare it for fermentation. They demonstrated that the use of hot stone technology in a wooden trough is effective in the production of a basic form of beer made of malted grain, water, yeast and herbal additives. The apparent success of the experiment, combined with the suggestion that cereal produce may have been processed at burnt mounds as indicated by the occasional presence of querns, led them to conclude that these sites functioned primarily as Bronze Age micro-breweries (Quinn and Moore 2007; 2009). This was supported by the long history of fermented beverages in many parts of the world, as well as numerous ethnographic parallels of beer brewing with hot stone technology and residues associated with some ceramic vessels.

The main argument against this hypothesis is the total absence of cereals and other relevant plant remains used for brewing from the excavation of over 1000 sites in Ireland. It has been observed (McClatchie *et al.* 2007) that beer brewing is an activity that requires large quantities of cereal grain. Since burnt mounds are sites where frequent firings take place, as well as localities that are often waterlogged, one would expect traces of brewing activities to be detectable in the archaeobotanical record. Despite the excellent preservation conditions on many burnt mound sites, recent research has shown that less than 8% of investigated sites contained cereal remains and then only in small quantities (McClatchie *et al.* 2007). This is confirmed by the current study where out of 1165 excavated sites in Ireland, none have produced considerable amounts of cereal remains. In fact, only 0.6% of excavated burnt mounds have produced cereals, the majority consisting of a few grains, most of which are interpreted as intrusive elements to the site. Quinn and Moore observed that the lack of cereal remains is explained in a number of ways. The use of spent grain was a valuable resource and would have been used as animal fodder or for bread making. They also propose that used malt is very susceptible to decay unless preserved by charring or waterlogging, therefore the limited sites containing cereal remains is actually a reasonable result (Quinn and Moore 2009).

However, as demonstrated by their own experiment, considerable amounts of grain are processed in the trough. If this was the primary purpose of these sites, large quantities of used grain should be trapped under and between trough timbers and trampled underfoot on the surrounding ground surface, in conditions that were conducive to preservation. No such remains have been found in well preserved timber-lined troughs in Ireland. If fired stone particles from the sudden cooling process become trapped in these areas then surely the spent material from the brewing process would also remain. If these troughs were deliberately backfilled as some were, the grain would also be less susceptible to microbiological decay. Furthermore, the waste stone deposited in the mound from this process would also bear the remains of spent grain with many becoming charred as a result of being deposited back in the fire.

Even though quern stones have been found at 18 excavated burnt mounds, their connection to brewing at these sites is not conclusive. Where their association with the site can be shown to be contemporary, this may have been part of other domestic chores carried out during the lengthy boiling processes. This is supported by the recovery of spindle whorls and flint knapping debris, producing further evidence for domestic activity at these sites.

While the aforementioned theories are based on common sense notions of practical use of hot water produced by a pyrolithic technology, the difficulty is that they cannot be supported by any firm evidence. For the most part, it is only through media interest and reiteration in the literature that some have come to accept these popular notions as established fact.

6.9 BURNT MOUNDS AS RITUAL SITES

One way to avoid the continued dislocation of 'ritual' activities from discussions relating to 'social' or 'domestic' use as a cultural construct is to recognize that human action is always both practical and symbolic (Brück and Goodman 2001). In this sense, any practical action is also symbolic because it reproduces the sets of values and social relations that are embedded in cosmological schemes. As such, it is difficult to make a clear separation of 'ritual' from 'non-ritual' in relation to burnt mounds and other sites in Bronze Age Ireland. All settlements, and by extension burnt mounds, of this period had particular religious observances and household rituals, which are very occasionally manifested in the archaeological record.

While acknowledging the practical aspects of such features, it must also be borne in mind that the symbolic and functional are intertwined (Parker-Pearson and

Richards 1994: 24). We cannot assume that everything we see is purely 'domestic' or 'functional' in character. It has been argued that people in the past did not have strict divisions between 'ritual' and 'domestic', instead most activities involved both (Bradley 2005; Tilly 1996: 62). Bradley (2003: 20) argues that ritualization was a process that affected many components of domestic life. This is where everyday or common acts took on special significance, where people ritualised particular aspects of their daily lives, providing them with added meaning (Bradley 2005; Tilley 1996).

Burnt mounds as feasting locations

Burnt mounds served a variety of needs and their social role may have extended to provide a venue for ceremonial events where ritualised feasting may have taken place at particular times of the year. These feasting events may have been linked to intense personal and collective experiences: on special occasions such as births, weddings, deaths, rites of passage, religious festivities, sowing and harvesting, seasonal changes etc. While the archaeological literature now contains numerous accounts of feasting in other parts of the world, there have been few attempts to integrate evidence of feasting in an Irish prehistoric context. It has been almost impossible to undertake this type of analysis from single sites in Ireland due to limited excavation together with poor preservation and sampling. It has also been observed that feasting is a tremendously variable phenomenon that is difficult to define (Twiss 2008). In most cases, prehistoric faunal assemblages in Ireland do not provide clear indications of ceremonial feasting (McCormick 2009: 406). Mount (1994) argued that the animal bone assemblage discovered in front of the passage tomb at Newgrange, Co. Meath is indicative of feasting practices, while similar evidence may be present at a number of other megalithic tombs in Ireland (Manning 1985; Jones 2007). As mentioned previously, most assemblages are too small to give unbiased information about animal exploitation (McCormick and Murray 2007). In order to overcome these limitations, it may be useful to take a broader look at what characterises feasts in other prehistoric cultures.

The feast is seen as being a less frequent event, taken outside the home base at some significant location, and following its own distinctive rules in relation to such matters as food choice (Jones 2002). Hayden observed that feasting can be broadly defined as 'the sharing of special food on special occasions', while Twiss defines feasts as 'occasions consciously distinguished from everyday meals, often by a greater number of participants and a larger supply of food' (Hayden 2001: 28; Twiss 2008: 419). Furthermore, she suggests that the modes of preparation, the discarding of food waste and the locational framing of the event may also distinguish certain feasting occasions (Twiss 2008: 419). Certainly, burnt mounds would have been prime locations for such activities, as they were often separated from contemporary settlements, while the method of cooking employs a different application, notably the use of a pyrolithic technology using an indirect heat rather than a direct one. As with modern behaviour in western societies, the novelty of this cooking method served to emphasis the special nature of the occasion.

The size of certain excavated troughs also (up to 5m in length) indicates large-scale boiling episodes for the cooking of large amounts of meat. Roycroft observed that during the Bronze Age, small farming communities/families with several small herds may have had a surplus of 10–20 beasts that were not worth feeding, or that could not be fed through the winter (2006: 38). He proposed that burnt mounds may have been used for large-scale processing of butchered carcasses. While evidence pertaining to the preservation of meat during this period is limited, the consumption of large amounts during a single event is nevertheless possible. It is more difficult to establish, however, whether this meat was consumed on site or taken elsewhere. The division of a carcass within a group could also have been used as a means to reinforce social order at meal times, with higher quality cuts restricted to those of higher social standing (McCormick 2002). Pollard observes that 'animals are woven into the fabric of social life through their ubiquitous presence and involvement in the creation and maintenance of social relations as a medium of exchange, feasting and offering' (Pollard 2006). Ethnographic accounts confirm that in many indigenous societies cattle symbolise wealth, power and prestige, and their meat was only consumed during feasting rituals (Jiménez and Montón-Subías 2011: 143). It is noteworthy in this regard that cattle dominate the animal bone assemblages from burnt stone deposits of Bronze Age date in Ireland.

It has also been noted that there is a strong association between feasting and ritual activity. As Fleming observed, a ritual area should provide a focal point for the activities of the principals, and should ideally be large enough to hold the participants and preferably designed to circumscribe them in some way (Fleming 1972). Because of waterlogging at many burnt mound sites, the availability of this space may have been important to the performance of the feasting ceremonies; indeed, the entire area around the trough may have been symbolically charged. The identification of trackways and stone surfaces implies the movement of people around the central working space of a site, while the placing of the hearth and mound material on the shorter ends of the trough controlled the movement of people in these activity areas. This may be relevant here large scale feasting involved an audience looking into the central working space.

Feasts are often marked by the production and display of commemorative items, which not only commemorate the feast but retain some of its ritual power (Twiss 2008; Hayden 2001; 2011). The careful deposition of objects as part of non-funerary rituals at the site may bear witness to such episodes taking place. The occurrence of votive offerings, as hoards, foundation, or closing deposits is a feature of the broader contemporary landscape in the

Bronze Age (Brück 1999; Cleary 2006). While the types of objects found in hoards and votive deposits are rarely encountered at burnt mounds, evidence of special deposits at these sites is now evident in the archaeological record. These include items of stone, metal, bone and wood, some of which are comparable to structured deposition at Bronze Age settlements. These episodes of deposition may have occurred at critical points in the lifecycle of a burnt mound. They may relate to the death of a member of society, the ending of a social relationship or the abandonment of the site or nearby settlement. These types of events may also account for the use of decommissioned artefacts, animal and human remains; all strong symbols of the end of one life cycle and the beginning of another.

The considerable effort required to carry out pyrolithic water-boiling imply high cost, reflecting the importance of these feasting events for communities. It must be admitted that the association of feasting and burnt mounds should be viewed with caution until confirmed by future excavations and scientific studies of faunal remains. No single data-set is likely to be diagnostic of feasting, especially since many sites lack several of the material correlates described above. However, special occasions may have warranted gatherings for feasting and the importance of such events is supported by evidence of specialised structures, large troughs, animal bone assemblages and deliberate deposits from a number of sites.

Aspects of commemoration

Ullén notes that in certain contexts 'refuse acquires a significance transcending the practical and functional' (1994: 254). In this sense, it is possible that burnt stone was not considered useless or unwanted material to be hidden away and forgotten. Instead, such materials were retained, valued and remembered. Built up over a significant period of time, burnt stone deposits might have acquired special significance that reinforced community identities and helped create links between inhabitants and their ancestors (see Chapter 5; Luby and Gruber 1999: 103).This is an emerging trend in archaeology over the past few decades. For instance, midden deposits in some cultural contexts were a result of selective and ritualized deposition of food related remains (see McNiven 2013). Such ritualization produced 'highly observable, monumentalized features within settlement locals with on-going expressive and generative structuring properties in terms of social relationships and identity' (*ibid.*).

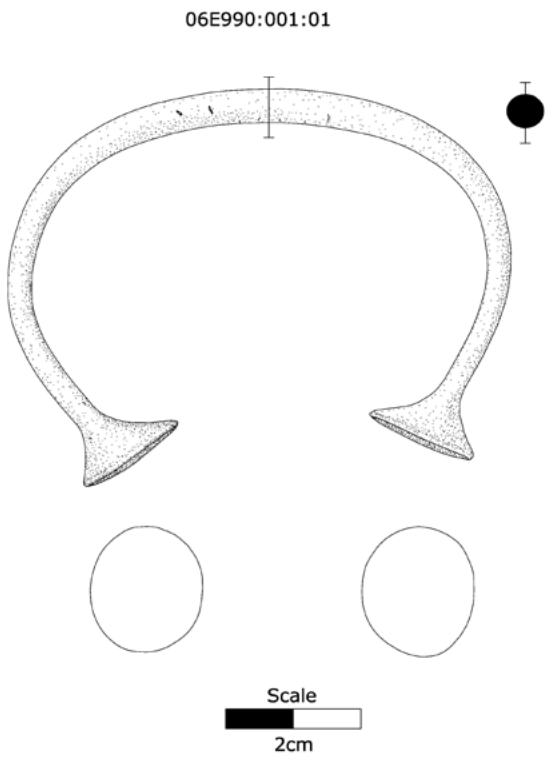

Figure 6.21. Gold bracelet from Ballymaclode, Co. Waterford. Source: Judith Carroll

Burnt mounds are quite different from other monuments which appear in the Neolithic and Bronze Age. What may be significant is the act of deposition, taking burnt and unusable stone and forming mounds, bringing them into the realm of social memory by making them places associated with feasting and myths of particular families or communities of those areas. Given these deposits comprise materials that were selectively gathered during routine social life (wood, stone and water) the familiar process of their collection could have served as a focus for memory— at one level, memories of specific tasks such as the construction of a boiling pit, the killing/butchery of an animal, the shattering of stone, sharing of food; on another level, of the flow and rhythm of social life, common actions familiar to most prehistoric groups. It is for this reason that burnt stone mounds should be viewed as intentional cultural features/deposits and not simply accidental mounds of refuse (see McNiven 2013).

As outlined by others (Gifford-Gonzalez 2014; Brück 1995; Cleary 2005), western cultures relegate waste materials to a single, comprehensive category, 'rubbish' or 'trash'. However, we know from ethnographic and other archaeological studies that people did not dispose of waste in the same manner in prehistory and was not usually viewed as insignificant. Refuse was sometimes symbolically meaningful and socially communicative in variable ways across different cultural contexts. Thomas (1999: 70-71), for instance, argued that domestic refuse may have been 'a means of commemorating particular events, whether feasts, gatherings or periods of occupation', resulting in 'a durable trace of their memory' for 'a particular practice or social grouping'. Could mounds of burnt stone and other 'refuse' found in these contexts be interpreted in a similar way?

Burnt mounds in Ireland are rarely greater than 1.5m in extant height or overall thickness. Even factoring in later disturbance, it seems that the use of water-boiling locations and the mounding of fired burnt stone ceased at a particular point in time. While this may relate to environmental or economic conditions, it is also possible that, after generations of use, a decision was made to formally

Figure 6.22. 'Iron-rich' deposit found in the centre of a trough at Coolroe, Co. Mayo. Source: Richard Gillespie for Mayo, County Council.

Figure 6.23. Remains of cylindrical wooden container found within Mound A at Clowanstown Co. Meath. Source: Matt Mossop for ACS Ltd and Transport Infrastructure Ireland.

abandon a site for a new one. This may be supported by the discovery of 'specialized deposits' recorded not only in troughs (see Hawkes in press), but also into the burnt mound proper during the final use phase of a site. The layering of burnt stone deposits, when evident, can be quite complex with additional features such as later troughs and fire episodes often recorded. Arrangements of specialized artefacts composed of stone, metal, bone and wood can also occur between layers or deposited into mounds as a way of formally marking significant stages in the lifecycle of the site. For example, at Ballynatona, Co. Cork, a Middle Bronze Age flanged axehead was found at a depth of 1.22m in the burnt mound, resting on 0.15m of similar mound material (Cherry 1990: 50). A gold dress-fastener is recorded from a burnt mound at Dooros, Co. Mayo, while at Ballymaclode, Co. Waterford, two Late Bronze Age gold bracelets were found in the upper layers of the burnt mound, one at the topsoil/mound interface and the other at *c.* 0.05m into mound material (Cherry 1990; Pollock 2009; Figure 6.21). Cahill (2009) observes that 'the fact that the type B2 bracelet from the site survives as two folded up fragments suggests that it was in a transitional, if not the final stage, of its life as a bracelet. The folding of gold objects prior to deposition is known from early to Late Bronze Age contexts (*ibid.*). Interestingly, it has been suggested that a burnt mound on the shores of Mooghaun Lough may have been the find-spot of the Great Clare gold hoard of 1854 (Condit 1996).

A small number of burnt mounds have produced evidence of possible foundation deposits. This includes a site at Killeens, Co. Cork (CO05), where a gold-covered ring was found beneath the timber lining of the pit. A tin bead and a gold covered ring were identified under a similar plank-lined trough at Sonnagh, Co. Mayo (MO52) (O'Kelly 1954; Gillespie and Kerrigan 2010). A Late Bronze Age penannular gold ring was recovered under burnt mound deposits at Rathmore, Co. Wicklow (WW07), while a complete twisted copper alloy bracelet was recovered from the basal silts of a pit associated with a burnt mound and structure at Bestwall in Dorset (Ladle and Woodward 2003). While most of these have been interpreted as artefacts lost during site construction, it is equally possible that they were deliberately deposited as an 'act of foundation' given the rarity of some artefacts, such as the biconnical bead at Sonnagh.

More convincing, however, is evidence of possible 'closing deposits' at these sites. For instance, at Coolroe, Co. Mayo (MO12), an 'iron-rich' deposit, was found at the centre of the trough. It is interpreted as naturally occurring bog ore that replaced or fossilized organic matter that was placed in a wooden container that was inverted in the base of the trough after its final use. The wooden vessel did not survive but the contents retained its original shape. (Gillespie 2010: 13; Figure 6.22). At Clowanstown 1, Co. Meath (MH82), the site was seemingly 'decomissioned' by the insertion of a wooden cylindrical container in the centre of the mound when the site was abandoned (Figure 6.23). All four mounds at the site were subsequently sealed with burnt 'cairn' material forming a monument over each. A more extensive stone spread then sealed

Figure 6.24. Yew wood pipes thought to be part of a musical instrument (dated 2137—1909 BC) found in the base of a plank-lined trough at Charlesland, Co. Wicklow. Source: Margaret Gowen & Co. Ltd

the cairn material including a number of lithic and bone finds, as well as evidence for at least seven animal skulls (Mossop 2008). Further evidence of 'decommissioning' may be inferred by the placement of two large boulders found in troughs at Chapelbride 5, Co. Meath (MH54) and Newtown, Co. Louth (LH18), while stone cappings may have been deliberately placed overlying the fills of troughs at Deerpark East, Attireesh and Gortaroe, Co. Mayo (MO24, MO26 and MO30; Gillespie 2001).

At Charlesland, Co. Wicklow (WW22), a set of Early Bronze Age wooden musical pipes were found deliberately deposited in the base of a timber-lined trough (Molloy 2003; Figure 6.24). At Claristown, Co. Meath (MH06), a stone pestle and mortar were interpreted as being 'votivley deposited' in a similar context (Murphy 2001). Other food processing artefacts such as saddle querns have been found deposited in troughs such as Charlesland, Co. Wicklow (WW23), Ballyduff East, Co. Waterford (WD22), Inchirourke, Co. Tipperary (TY63) and Kilmacredock Upper, Co. Kildare (KD04), while at Kilree 1, Co. Kilkenny (KK59), the saddle quern was deliberately placed on top of a pit filled with domestic waste. At Sranagalloon, Co. Clare (CE59), the presence of a worked yew rod with axe chop-marks sealed within a fill of re-deposited subsoil suggests that it may have been placed deliberately. The function of the yew rod is impossible to determine, however wear marks on one end point towards a specific use such as pounding or mixing or even stunning animals (Nunan 2010; O'Carroll 2010).

At Ballynakelly, Co. Dublin (DN30), once the heating of water and the subsequent dumping of heated stone in and around an adjacent well had ceased, a thick layer of organic-rich silt with wood inclusions began to accumulate in the feature. A well-preserved Middle Bronze Age palstave and numerous bound bundles of wood were deposited in this well pit, which served as a water source for the trough. The palstave and the bundles of wood appear to have been deliberately and consciously deposited at a time after the water heating activity had ceased. As the palstave from Ballynakelly appeared to have little use prior to its deposition, it seems possible that it was intentionally placed in the pool rather than being accidentally lost (McCarthy 2010). It is also unlikely that such a valuable and substantial artefact could have been abandoned unintentionally. The fact that the palstave did not come from the burnt mound itself, but from the well, may in itself be interesting, as it is more likely to reflect a votive offering, deposited in a watery place, similar to artefacts found in wells at Clogh East, Co. Limerick (LK39), Cuffsborough, Co. Laois (LS34) and Clonee, Co. Dublin

Cat. No	Site	County	Context	Type	Cremated
CE29	Cragbrien	Clare	Burnt Mound	Skull	N
CE30	Cragbrien	Clare	pit	Burial	Y
LK45	Inchagreenoge	Limerick	Well	Skull	N
KD33	Moone	Kildare	Trough	Humerus	N
KD32	Belan	Kildare	Trough	Skull	N
WM40	Kilbeg	Westmeath	Causeway?	Femur	N
OY04	Ardan	Offaly	Trough	Burnt and unburnt bone	N
CW06	Busherstown	Carlow	Mound deposit over well	Femur	N
KD22	Inchaquire	Kildare	Cist	Burial	Y
MH74	Johnstown	Meath	Well/pit	Disturbed burial?	Y
MH79	Knocks 1	Meath	Pit	Femur	N
MH59	Philpotstown 1	Meath	pit	Burial	Y
WM	Mullingar	Westmeath	Burnt Mound	Disturbed burial?	Y
MH82	Clowanstown 1	Meath	Burnt Mound	Humerus	N
MH41	Leshemstown	Meath	Burnt Mound	Burial	N
KD04	Kilmacredock Upper	Kildare	Pit	Burial?	Y
LK61	Coonagh West	Limerick	Ditch	Tibia	N

Figure 6.25. Human bone recovered from excavated burnt mounds in Ireland.

(McCarthy *et al.* 2009). Deliberate well deposits have also been noted elsewhere, such as Swalecliffe in Kent where a large upturned ceramic vessel was found in the base of a large pit that functioned as a well. It was interpreted as an offering possibly in an attempt to increase water levels in the pit (Masefield *et al.* 2003: 114). Deposits of animal remains have also been interpreted as being deliberately placed in these features. Vertebrae and skull fragments found in the base of a large pit at Arbraccan, Co. Meath would have effectively terminated any use of the pit as a drinking supply (Mossop and Ruddle 2009), while the intact skull of a large cow was recovered from the base of a well at Rath, Co. Meath (Schweitzer 2009).

Human bone was also occasionally placed in closing deposits at burnt mounds (Figure 6.25). When associated with troughs, these deposits can be interpreted as a way of sealing the site, similar to other objects found in these features (see above). Human remains have been recovered from 17 burnt mounds in Ireland, four of which have been interpreted as deliberate deposits, including Inchagreenoge, Co. Limerick (LK45), Cragbrien, Co. Clare (CE29), Belan, Co. Kildare (KD32) and Leshemstown, Co. Meath (MH41).

Figure 6.26. Remains of human skull found in the base of a spring at Inchagreenoge, Co. Limerick. Source: Grogan *et al.* 2007).

The complete skull of an adult male was found deliberately placed in the bottom of a spring at Inchagreenoge, Co. Limerick (Figure 6.26), while at Leshemstown, Co. Meath, the crouched inhumation of an adult female was broadly contemporary with the dated trough. The burial represented the formal deposition of an articulated individual at a time when cremation seems to be the norm in Middle to Late Bronze Age Ireland. Furthermore this burial was placed into a burnt mound, a site not normally associated with the deposition of human remains (Figure 6.27). The nature of the back-fill in the grave at Leshemstown, which contained no evidence of vegetation growth or organic formation, suggests that little time had passed between the deposition of the mound material and the actual burial. It appears to have been sealed by a final deposition of burnt material after the grave had been back-filled. This suggests that not only where the burnt mound and the burial broadly contemporary but that pyrolithic activity continued after the person was interred (McGowen and Fallon 2010). A burnt mound at Feltwell Anchor, in Norfolk, England produced a similar inhumation of an adult female dating to the Chalcolithic, interred within a wooden coffin or mortuary structure some time after the final phase of use of the mound (Bates and Wiltshire *et al.* 2000). The insertion of inhumations through the centre of mounds at Feltwell Anchor and Leshemstown 5, Co. Meath must at least identify the larger mounds as visible monuments. This concept can also be demonstrated in South Wales, where a standing stone is sited atop a burnt mound (Crane and Manning 1998). Examples such as these may suggest an occasional ritual or ceremonial ‘closing rite’ associated with the end of the lifecycle of the site. That said, few of these examples provide unequivocal evidence of ritual deposits, as other explanations may apply to the circumstances of their deposition. These examples also represent a small minority (<5%) of excavated burnt mounds in Ireland.

Figure 6.27. Crouched burial cut into burnt mound at Leshemstown, Co. Meath. Source: CRDS Ltd.

At Belan, Co. Kildare (KD32), disarticulated human remains from the topsoil consist of two tibiae, a right femur and a left humerus, while skull fragments were recovered from the uppermost fill of the trough. Radiocarbon dating confirmed that the human bone recovered from the trough and topsoil were contemporary with the burnt mound site. The dates also indicate that there were two individuals

present, as there is a minimum gap of 430 years between the two samples. While there is a strong possibility that the disarticulated bone may have been an unrelated burial, disturbed by topsoil stripping, the deliberate and possibly symbolic deposition of human skull fragments within the trough suggests a votive offering made as part of a closing deposit. Similarly, at Cragbrien, Co. Clare (CE29), human skull fragments and part of a facial bone from an adult male were deposited within the mound in its last phase of use (Grogan *et al.* 2007: 94). Also, as mentioned previously, during final phase of the Inchagreenoge burnt mound, the skull of a young adult male deposited in a spring that was sealed by a stone capping. This is radiocarbon dated to 1260–1010 BC. One badly preserved piece of human femur bone from the spread of the burnt mound at Busherstown, Co. Carlow (CW06) is dated to 1384–406 BC, while human femur bones were also discovered at Knocks, Co. Meath (MH79) and Kilbeg Co. Westmeath (WM40). Finally, an adult humerus was recovered from a primary Iron Age deposit on the western side of a burnt spread trough at Moone, Co. Kildare (KD33). A similar human femur was recovered from one of the Neolithic burnt mounds at Clowanstown 1, Co. Meath (MH82) while a human tibia was recovered from a palaeochannel at Coonagh West, Co. Limerick (LK61).

It has been suggested that burnt mounds may have been used for the processing of human bone, connected with ceremonies associated with cremation (Ó Néill 2000a: 19; Grogan *et al.* 2007: 98). The spatial association of some burnt mounds with individual Bronze Age burials and a number of cemeteries lends some support to this claim. As noted above, human bone has been uncovered from a small number of burnt mound sites, the majority found in an unburnt condition. Could the water-filled troughs be related to a pre-burial rite whereby corpses were purified in heated water prior to cremation? Certainly, cooking and death involve transformations from one state of being to another, and both usually have some ritual associations in most societies. There is little evidence to substantiate such ideas at the present time (Grogan *et al.* 2007: 98). It cannot be concluded that burnt mounds were used as places for mortuary rituals, rather it suggests that they were located in places where such activities took place (Bradley 2007). It is more likely that much of the human remains found at burnt mounds represent deliberate deposits associated with abandonment rituals.

These deliberate deposits were surely meant to be seen, to be consumed and appreciated by onlookers before being finally buried. As discussed by Pollard (2001) the careful mixing and interleaving of such items with more general 'waste' material (burnt stone, animal bone, ash, fire debris, flint, pottery) created another set of relationships that drew in more generalized qualities considered inherent in particular places. As such the deposition of material culture might have been an important way of remembering or emphasising particular connections to social places in the landscape.

6.10 CONCLUSION

In the history of burnt mound research, the function of these sites has often been conceived in terms of the depiction of what seems to be similar processes in the early literary sources. There is now considerable archaeological evidence to support early suggestions that burnt mounds were used as locations for the cooking of food. A review of ethnographic studies of hot-stone cooking provides possible points of comparison, especially with regard to how various unlined pits may have served as cooking facilities. This should not exclude a number of secondary uses, as the technology was also possibly connected with steam bathing at different times during the Bronze Age. Our understanding of burnt mounds and how they operated in the daily life and work routines of Bronze Age society must also be placed against the nature of excavated evidence of recent years. Archaeological excavation of burnt stone sites in Ireland has largely focused on the results from road and pipeline developments where sites have been severely damaged. That said, the large number of excavated sites in Ireland, currently placed at 1165 examples, provides a large data-set to consider their active use and broader significance.

The rapid adoption of pyrolithic technology in Bronze Age Ireland was not based on a search for more efficient cooking techniques, but rather on the social contexts of its use. It has been argued elsewhere that pyrolithic water-boiling technology of the Early Neolithic may have operated on a communal level associated with specialised feasting activities (Hawkes 2014: 26). It could equally be argued that some burnt mounds became a symbolic focus of group unity during the Bronze Age. While small deposits of burnt stone with associated pits may be typical of ad hoc cooking episodes representing a different scale of pyrolithic activity, the larger mounds are marked by a higher level of labour mobilisation and possibly, some degree of inter-group cooperation. Instead of isolated hunting camps, we should expect these sites to have been located within the environs of a contemporary settlement, with the occupants returning regularly to these special locations. As a result it is possible to see the importance of the community in Bronze Age Ireland in the social dynamics of burnt mound use and their presence in the landscape. The possible relationships between pyrolithic areas and contemporary settlement sites will be explored further in Chapter 7.

Chapter 7

Settlement Context

This chapter examines the spatial association of burnt mounds to local settlement sites, to explore the connection these sites had with communities in a settled landscape. While the functional relationship between burnt mounds and residential sites is complex, dependent to a great extent on dating evidence of contemporaneity, recent indications from developer-funded projects offers new insights into these associations. This form of large-scale landscape excavation indicates that the majority of burnt mounds were probably located a short distance from contemporary settlements, which can be demonstrated for several sites considered in this study.

7.1 AN ARCHAEOLOGY OF BURNT MOUND SETTLEMENT

The earliest excavations of these sites generally focused on extant features, such as the burnt mound and troughs, and typically did not investigate the environs of a site. The damp environments in these boiling sites would not have been conducive to permanent habitation, to the extent that water drainage measures and stone surfaces were required at many sites (Chapter 4). A small number of excavations, however, have produced evidence of built structures including roofed huts. In many cases, those structures were designed for the use of the pyrolithic technology and not for permanent occupation (see Chapter 4 and 6).

Reference can be made here to burnt mounds excavated on the Northern and Western Isles of Scotland, which have stone built structures and internal stone-lined troughs (see Chapter 2). It has been argued that these structures were permanent domestic dwellings (Hedges 1977; Barber 1990). Recent studies question this interpretation, arguing instead that these buildings were constructed for a specialised purpose (Dockrill *et al.*1998; Dockrill 2007). Even though the ground plans appear similar to other domestic structures, these buildings are clearly centred on the water troughs, with space for other activities limited. The boggy locations of some of these Scottish sites are also not conducive for domestic settlement. Excavation in Shetland, at south Nesting (Dockrill *et al.* 1998) and Kebister (Owen and Lowe 1999: 257), suggests that burnt mounds played a specialised role within Bronze Age landscapes, but did not constitute the permanent settlements of the Northern Isles (Dockrill 2007: 394). In Ireland, it was initially suggested that burnt mounds represented areas of transient settlement or temporary hunting camps (O'Kelly 1954), another view that is no longer accepted. Rather than looking at sites in isolation, the emphasis now is on understanding their local landscape setting. It is now considered that troughs with evidence of substantial coverings served a special purpose role relating to cooking or bathing, whereas other structures may have functioned as temporary shelters or huts best suited for steam-bathing (see Chapter 6). As observed by others (Bailey 1996: 148; Cleary 2007: 52), dwelling activities, such as eating and sleeping, are automatically assigned to structures interpreted as houses. While these may have been one element of life undertaken, the importance of other dwelling activities must also be explored. It is likely that adjacent drier areas, particularly along the slopes of river valleys would have been the location for permanent habitation. This would still leave settlement areas and burnt mounds quite close, in many cases no more than a short walking distance apart.

Burnt mounds may be considered a specialised form of 'settlement site', whose distribution is a proxy indicator of contemporary setlement. Due to duration and repetitive use of the water-boiling process (see Chapter 6), some of these areas must have been 'occupied' for considerable periods of time. As discussed in Chapter 4, many post-built structures in these burnt mound sites probably served as temporary shelters or revetment features, while other stake-hole arrangements probably represent light coverings for water-pits during adverse weather conditions. A settlement is seen to 'provide living and sleeping quarters for a significant portion of the day, season and year' (Needham and Spence 1996: 20). The act of selecting that settlement space implies the creation of a relationship with that place. The ways in which these relationships were marked and remembered is a vital insight into prehistoric beliefs. For example, residential houses, along with areas associated with pyrolithic processes and other locations associated with tool manufacture and storage, all played a vital role in everyday life and so were intimately associated with the lives of their occupants. These everyday activities probably grew to symbolise and create social relationships, and so it is not unusual to see special deposits relating to 'closing events' at these sites (see Chapter 6).

The overwhelming majority of excavated settlement sites in Bronze Age Ireland consist of one or two domestic houses (Ginn 2012: 27; Ginn 2016). Where additional structures have been identified, they are often of a different date or have a different function. As Ginn observes, 'the settlement record suggests that identification with wider communities occurred away from the residential space and that identity was largely based on the individual, and shared and reinforced primarily through kin-groups and

those encountered within the sphere of daily life' (2012: 27). Larger nucleated settlements or communities, such as Corrstown, Co. Derry (Ginn and Rathbone 2011), and possibly Ballybrowney, Co. Cork (Hanley and Hurley 2013), represent a conscious expression of identity different to the smaller isolated settlements more typically found in Ireland (Ginn 2012: 29). The latter can be viewed as separate entities in their own right, functioning as relatively independent or self-sufficient units and this is reinforced by the fact that many are frequently enclosed (Brück 1999; Cleary 2007). Most houses sites probably supported a single kin group or family, as suggested by the size of the structures and by the small assemblages of artefacts and ecofacts. The identification of contemporary burnt mounds within several hundred metres of these habitation areas confirms that the former mostly operated on a small family or kin-group basis (see below).

Ginn (2012: 30) observes that even though the overall pattern suggests dispersal of independent farmsteads, it does not indicate isolation, with many of these settlements in close proximity. This reflects a fundamental link with a community identity, in which these households would probably have shared a larger social space. The analysis suggests that this pattern of dispersal is repeated across Ireland with greater or lesser degrees of variability in different localities. This is suggestive of a model where identity was based to a greater extent on the kin group, and shared and reinforced primarily through those encountered within the sphere of daily life (Ginn 2012).

Renfrew's (1976) model of 'segmentary' societies is relevant here. He suggests that this can be expressed in spatial terms where a pattern of simultaneously functioning sites suggests spacing rather than clustering and where there is no hierarchy of places indicative of social hierarchy. The basic unit or 'primary segment' of this society was a residential unit like a village or an association of dispersed houses which make up '…a self-sustaining perpetual body, exercising social control over its productive resources (after Sahlins 1961: 325). Renfrew argued that in many segmentary societies the territorial division of land and resources is given symbolic expression with membership of the group and land occupied, expressed in rituals that are often focused upon a specific location (Renfrew 1976: 206). While this often takes the form of a ceremonial monument, it could also include burnt mounds.

The small number of excavated burnt mounds with evidence for enclosing elements represent a very deliberate definition of space (see Chapter 4). The vast majority were unenclosed, leaving boundaries between residential house and communal space and the location of burnt mounds typically unstructured. Therefore, burnt mounds may have been important in creating social spaces where people came together to meet and undertake specific tasks. The significance of external hearths, as proposed by Cleary (2007) in relation to Bronze Age settlements, could also be expanded to include burnt mounds, which are frequently found in the environs of settlements (see below).Their general occurrence in designated areas within the settled landscape suggests a clear separation, where particular places were selected for pyrolithic technology, partly for functional reasons, thereby creating a socially distinctive space. The revisiting of burnt mounds in later periods suggests that the locations of these sites were permanent elements in the landscape, even if the activity at each site was not a daily occurrence. This creation of controlled spaces is also attested to in the British archaeological record from the Middle Bronze Age onwards, whereby 'discrete spaces were defined and bounded through construction of enclosures, buildings, fences, ponds, hearths, burnt mounds and pits (Brück 2000: 285).

7.2 BURNT MOUNDS AS INDICATORS OF PREHISTORIC SETTLEMENT

The question of whether burnt mounds are proxy indicators of contemporary prehistoric settlement is a contentious issue and is usually posed against a background of limited site and cultural landscape information. Prior to large-scale infrastructural development, prehistoric habitation sites were generally rare in Ireland, leading archaeologists to turn to other indicators of prehistoric settlement, namely stray finds, stone ritual monuments, other special purpose sites such as burnt mounds. Therefore, most researchers tend to use burnt mound distribution as a surrogate settlement record, based on the reasonable assertion that these monuments were the foci of domestic activity over lengthy periods of time, with people who used them living in the same area.

How the siting and distribution of burnt mounds relate spatially to the location of their users' settlements is a matter of continued debate. This includes the manner in which the organisation of life space influenced burnt mound siting and whether the latter can tell us anything about settlement patterns. Grogan (2005: 41) states that the role of burnt mounds as proxy indicators of Bronze Age settlement is still uncertain, with some favouring their seasonal use in marginal areas and others suggesting their direct association with settlement in the near vicinity. However, he concludes that these explanations are not mutually exclusive (*ibid.*: 41). The general assumption is that the majority of burnt mounds were an integral part of a lived-in landscape, even if the locales themselves were regarded as somehow liminal. While individual pyrolithic sites had locational preferences that related to access to water and other raw materials such as stone and fuel (see below), it is assumed that the majority were probably sited within their immediate settlement context, if only for their practical use as cooking places.

A recent review of Bronze Age settlement in Ireland records 302 excavated sites (Ginn 2012; Ginn 2016). This material can be compared with the distribution of some 1000 excavated burnt mounds in Ireland (Figure 7.1). Using GIS analysis, a circular buffer zone of 1km was created around each known habitation area, which

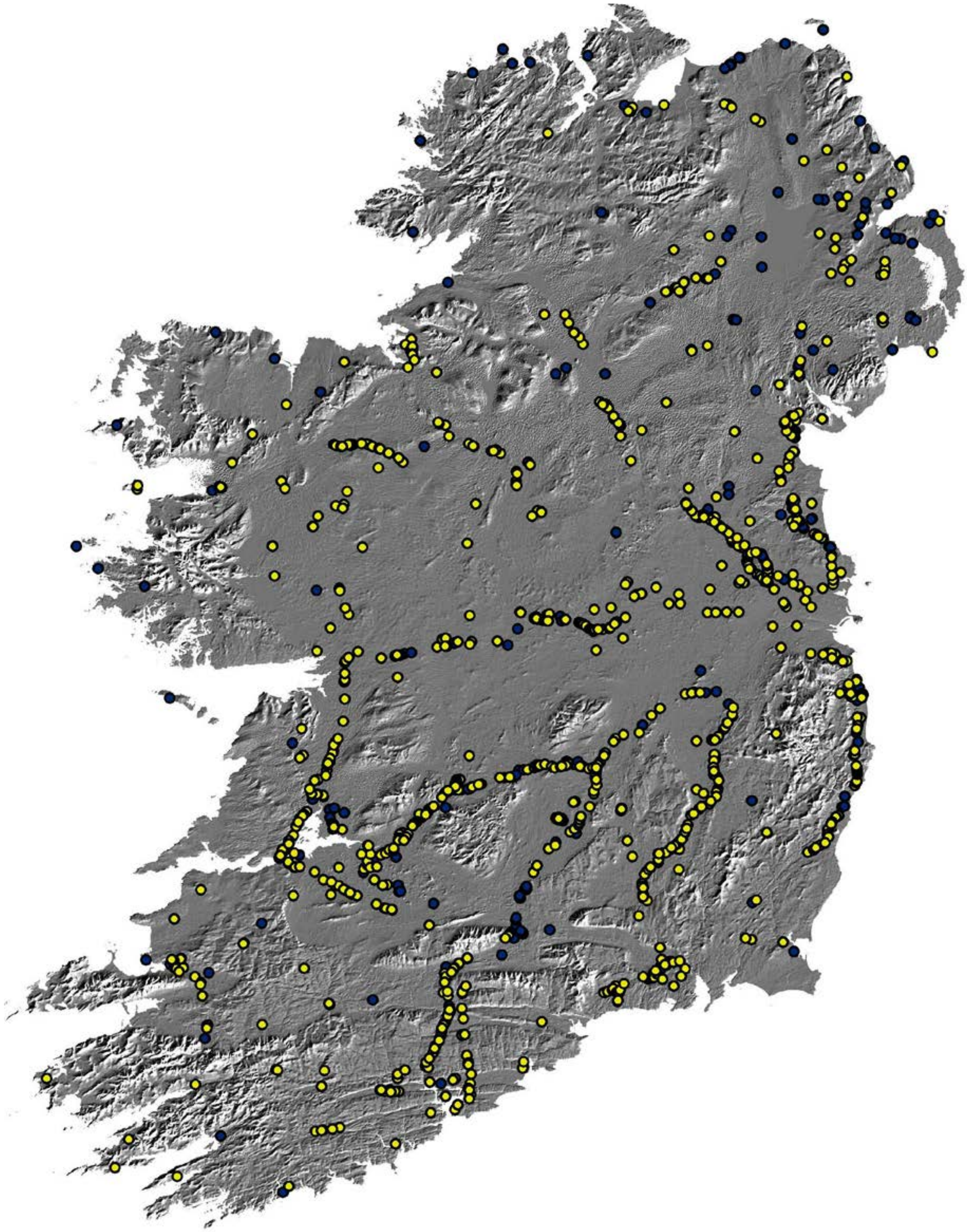

Figure 7.1. distribution of excavated burnt mounds and Bronze Age settlements. Yellow dots represent burnt mounds, while blue dots represent settlements.

revealed 175 excavated burnt mounds in these relatively small spatial zones.

An additional 183 unexcavated burnt mounds (RMPs) were also identified in these zones (there is a certain degree of overlap with a number of excavated burnt mounds included in the *Register of Monuments and Places*) (Figure 7.2; Figure 7.4). Considerable clusters of burnt mounds are noted in the immediate locations of at least ten Bronze Age settlements. These include townlands of Killulla, Co. Clare; Ballinaspig More and Fermoy, Co. Cork; Ballyquirk, Co. Kilkenny; Raheenagureen, Co. Wexford; Killoran and Carrigatogher Harding, Co. Tipperary; Caltragh Co. Sligo; Boyerstown, Co. Meath and Charlesland, Co. Wicklow. An arbitrary 1km buffer zone was selected due to the likelihood that pyrolithic sites associated with nearby family-based kin groups would be located in such proximity. However, it is recognised that

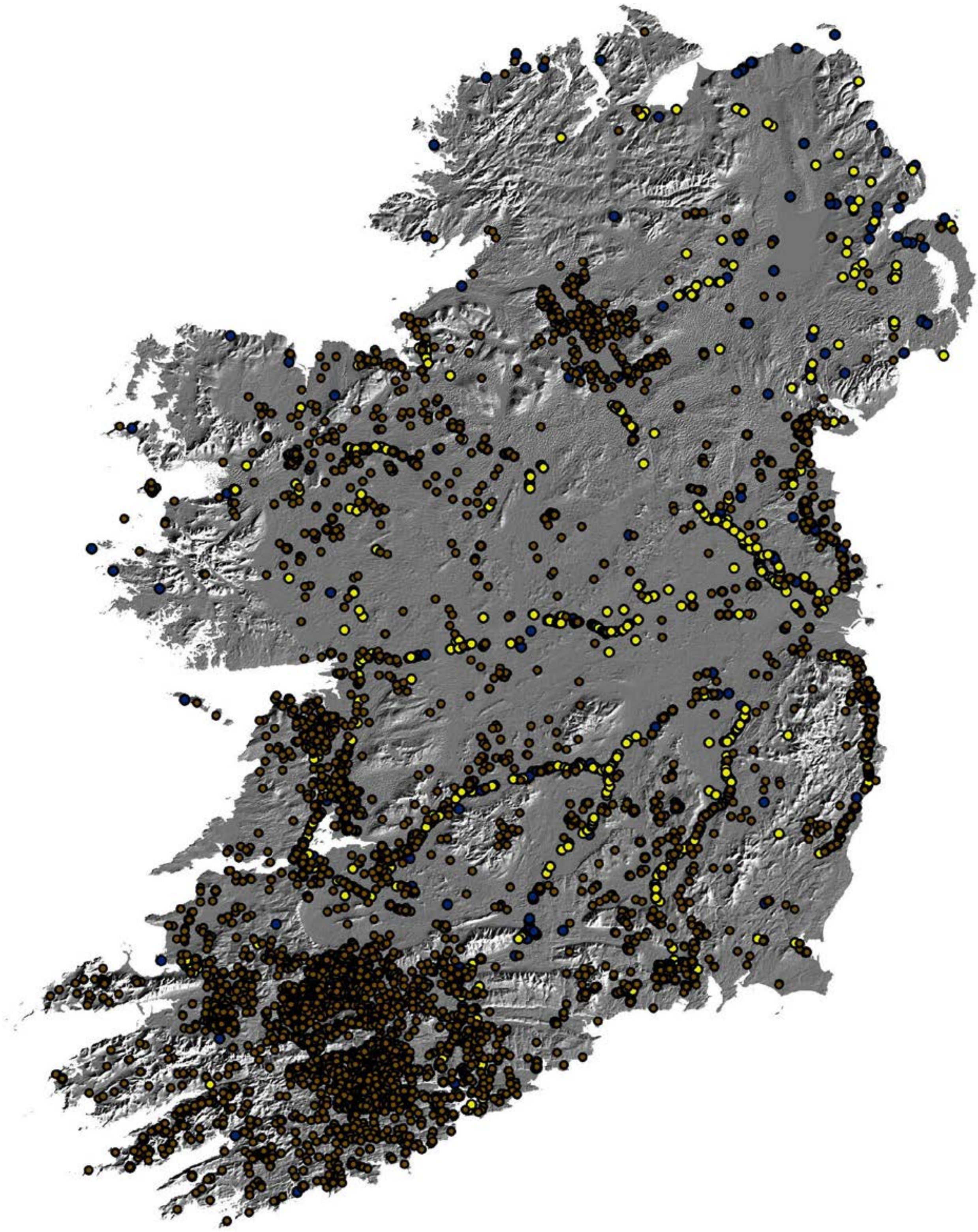

Figure 7.2. Distribution of burnt mounds (RMPs-brown dots) in relation to excavated sites (yellow) and Bronze Age settlements (blue).

these arbitrary divisions do not give a true representation of the overall settlement landscape. This 1km buffer zone was subdivided into smaller areas of 200m, recording the spatial relationship of excavated burnt mounds with Bronze Age settlement.

Taking into account the limitations of dating evidence from both burnt mound sites and areas of habitation, it is notable that the available radiocarbon evidence indicates many are broadly contemporary. The aforementioned clusters of burnt mounds located within the domestic space of several settlement sites is noteworthy, as is the fact that many of the former have produced similar artefactural assemblages such as at Killulla, Co. Clare (CE05–09), Cherrywood, Co. Dublin (DN05), Holdenstown, Co. Kilkenny, and Charlesland, Co. Wicklow (KK22). These

clusters are discussed below in relation to burnt mounds and domestic space.

Burnt mound sites 400m from known settlements

Some 68 burnt mounds and related pyrolithic deposits have been uncovered within 400m of excavated Bronze Age settlements in Ireland. This does not include structures discussed previously, such as Drombeg, Co. Cork (CO07), Ratheen, Co. Tipperary (TY28), Lisnagar Demesne, Co. Cork (CO52) and Coarhamore, Co. Kerry (KY03), which may relate to other specialised activities involving the use of pyrolithic technology (see Chapter 6). The structures identified here, are classified as habitation areas because of their size, design, and the recovery of material culture associated with domestic activity.

A number of burnt mound deposits have been identified in close proximity to Bronze Age settlements. At Cloghers, Co. Kerry (KY06), one undated burnt mound was located *c.*100m from a multi-period Bronze Age settlement, with an Early Bronze Age burnt mound identified 400m to the east. The latter was broadly contemporary with the earliest occupation of the site dated to the Chalcolithic. At Clonmore North, Co. Tipperary (TY34), a Middle Bronze Age burnt mound was located in close proximity to three contemporary structures, two of which were substantial and likely to have been used for habitation (McQuade *et al.* 2009: 121). A similar situation was identified at Caltragh, Co. Sligo (SO14), where contemporary burnt mound activity was identified within 100m of three large Middle Bronze Age houses (Danaher 2007: 40). A number of Bronze Age burials were also excavated in the general site area, combining the activities of the living and the dead and may represent 'people who had a relatively localised sense of self' (McCabe 2003). At Ballynamona 2, Co. Cork (CO72), three Middle Bronze Age structures were discovered 400m to the south of a Middle Bronze Age burnt mound with three troughs, two of which represented successive phases of use (Figure 7.5). Bronze Age burials were also revealed within the area exposed by the road development. At Laughanstown, Co. Dublin (DN16), an extensive area of pyrolithic activity contained a number of troughs and water-holes or wells, along with a large assemblage of pottery. Radiocarbon dating suggests the site had a long period of use from the Early to Late Bronze Age, and was broadly contemporary with a number of structures at nearby Laughanstown 40 and Laughanstown 78. At Clondacasey, Co. Laois (LS24), burnt mound activity dating to the Middle to Late Bronze Age was identified within 200m of nearby contemporary settlement. Interestingly, the sites at Laughanstown, Clondacasey and Coolfin all had large wells that would have provided essential clean water not just for pyrolithic water-boiling but for local families and communities. Another striking aspect of the spatial relationship between burnt mound locations and domestic settlement sites is the clustered nature of the distribution. At some 31 sites, two or more burnt mounds are located within 1km of known Bronze Age settlements. While notable concentrations occur within 200m of habitation areas, at Killulla, Co. Clare (CE05–09), Ratheenagurren, Co. Wexford (WX21),

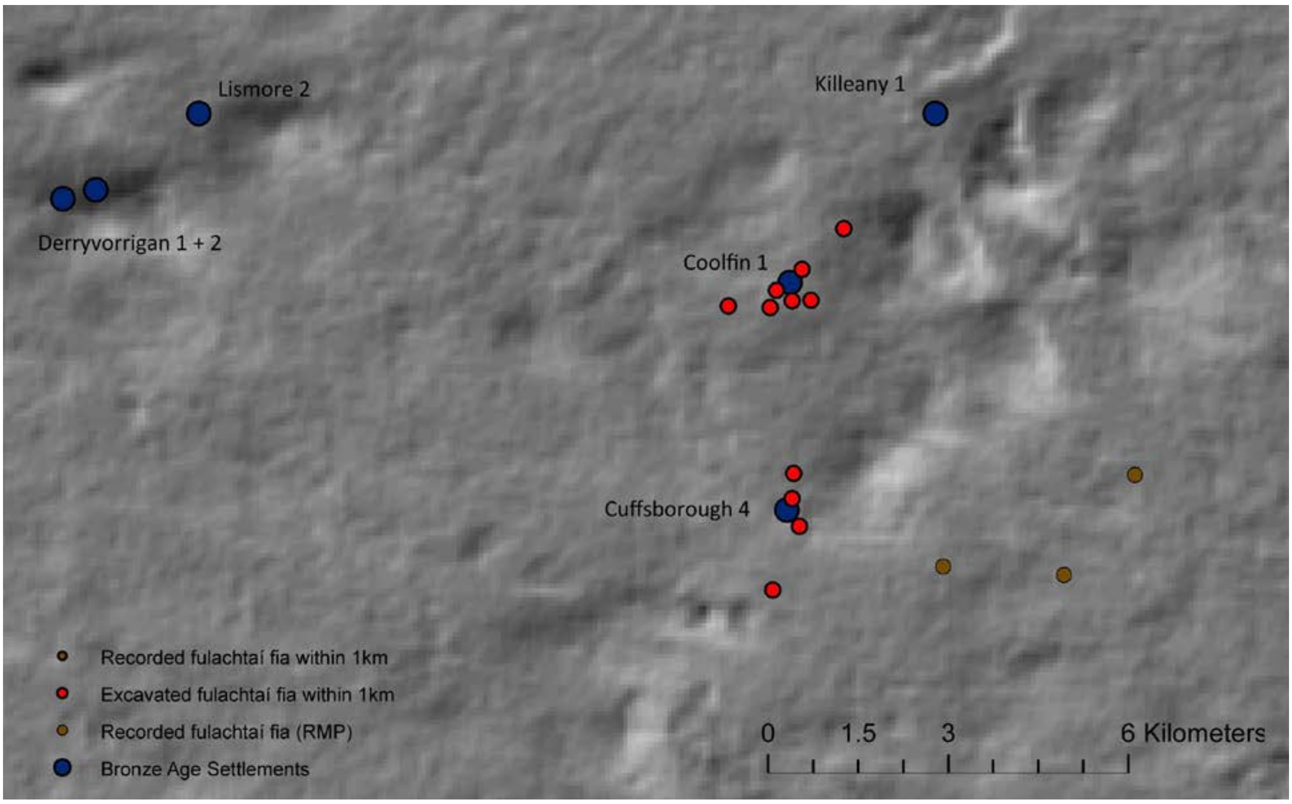

Figure 7.3. Burnt mound clusters within 1km of Bronze Age habitation at Coolfin 1, Co. Laois and Cuusborough 4, Co. Laois.

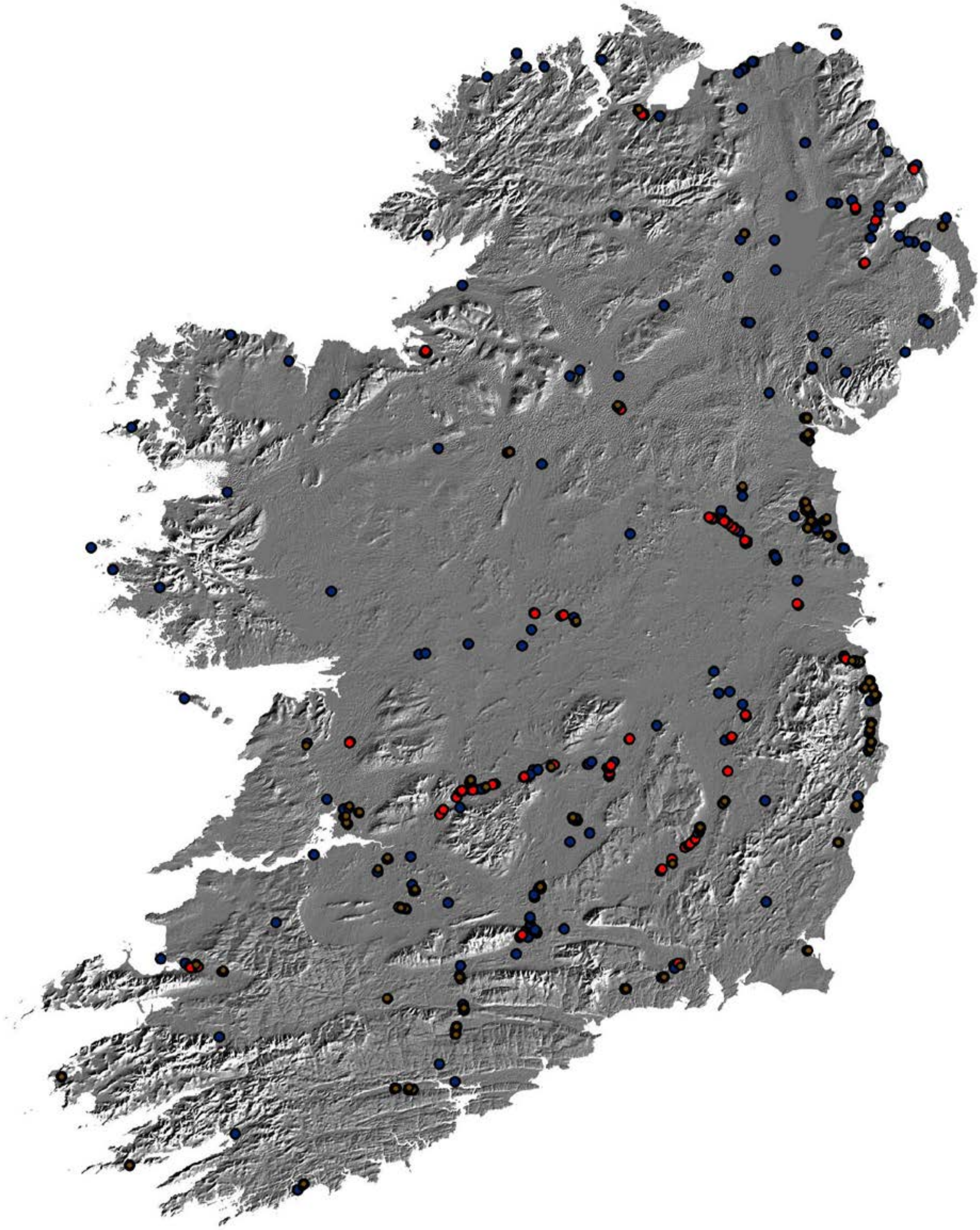

Figure 7.4. Recorded (brown) and excavated burnt mounds (red) located within 1km of prehistoric settlement (blue).

Carrigatogher Harding, Co. Tipperary (TY50–54) and Killoran, Co. Tipperary (TY01–18), the size of these clusters increase beyond a 200m radius of domestic houses.

This was the case at Caltragh, Co. Sligo (SO14–16), Ballinaspig More, Co. Cork (CO39–43), Fermoy, Co. Cork (CO48–50), Charlesland, Co. Wicklow (WW22–23), and Boyerstown Co. Meath (MH46–49).

At Coolfin, Co. Laois, four distinct areas of archaeological potential were discovered in relatively close proximity (Figure 7.3). These include a round house (Coolfin 1), a spread of burnt mound material with an associated well (Coolfin 3; LS28), four shallow pits filled with burnt mound material (Coolfin 2; LS27) and an isolated trough containing burnt mound material (Coolfin 4; LS29). The settlement at Coolfin 1 was situated to the west of

Springfield 3 (LS46), a Late Neolithic burnt mound on the higher ground, and consisted of a Middle Bronze Age roundhouse. Coolfin 2, 3 and 4 dated to the Middle to Late Bronze Age are located in the lower lying ground were associated with the use of pyrolithic technology. Settlement in that area was located in the higher, well-drained soil, whereas the burnt mounds were located in the low-lying areas adjacent to water sources such as streams or wells. Other pyrolithic sites in the area include Cross 1 (LS32) sited *c.*300m to the north-west of Springfield 3. This site consisted of a substantial spread of burnt stone material overlying a rectangular trough and an oval pit/trough. The site of Ballycuddahy 1 (LS11), *c.*800m to the north-east of Springfield 3 consisted of a trough and three associated burnt mound pits. The neighbouring townland of Cuffsborough was also an archaeologically rich area. The site of Cuffsborough 2, 300–400m to the south of Springfield 1, consisted of multi-period Bronze Age settlement and cremation activity. Further south, Cuffsborough 1 and 3 (LS33 and LS34) contained extensive burnt mound activity dating to the Middle to Late Bronze Age. The settlement at Cuffsborough consisted of a 17m diameter ring of large posts and a slot trench of Early to Middle Bronze Age date.

Figure 7.5. Middle Bronze Age roundhouses at Ballynamona, Co. Cork (top) and burnt mound and ring-ditch located 400m to the north. Source: Eachtra Archaeological Projects.

When considering this evidence, it is apparent that the burnt mounds at Coolfin and Cuffsborough were components of a wider Bronze Age settlement pattern that spanned the Final Neolithic to the Late Bronze Age. This is consistent with Cooney and Grogan's (1994: 141) analysis of prehistoric settlement patterns in Limerick, where they observed an 'emergence of a complex landscape organisation, with extensive cemeteries, domestic sites and burnt mounds forming an integral pattern' during the Bronze Age. The landscape at Coolfin was obviously deemed a suitable location to conduct burnt mound activities and was revisited over a long period of the Bronze Age.

Considerable pyrolithic activity was also recorded in the townlands of Carrigatogher Harding and Ryan, Co. Tipperary, in advance of the N7 Nenagh to Limerick road scheme. A cluster of five burnt mounds (TY50a-b; TY51; TY52a-c; TY53; TY54), were identified in close proximity to a multi-period Bronze Age settlement complex. It has been observed that the narrow valley of the Kilmastulla River through the mountainous Silvermines/Slievefelim/Arra region would have provided an obvious routeway through the difficult terrain. This explains the large concentration of archaeological sites in that region as such thoroughfares were favoured areas for settlement (Grogan 2005: 27). At Killoran, Co. Tipperary, a dense cluster of burnt mounds (TY02-TY18) was discovered in close association with a series of roundhouses dated to the Middle Bronze Age. A particular concentration of three burnt mounds located within 200–250m of the habitation area are dated to the Late Bronze Age (TY03; TY04; TY05). Their chronological relationship, however, cannot be established as the individual burnt mounds were not securely dated.

Burnt mound sites 400m–1km from known settlements

The greater the distance a burnt mound is located from a contemporary settlement, the more frequent they become. For example, two burnt mound deposits are recorded within 400m of a known Bronze Age settlement at Ballinaspig More 5, Co. Cork, however, within 1km of the site a further three sites can be included. Similarly, the Bronze Age habitation site at Fermoy 3, Co. Cork, is located within 400m of a burnt mound, whereas an additional six sites can be included when the buffer zone is increased to 1km. The same can be said for sites at Ballyquirk, Co. Kilkenny, Killoran, Co. Tipperary, Caltragh, Co. Sligo, Charlesland, Co. Wicklow, and Boyerstown, Co. Meath.

Other burnt mound sites can be located at a greater distance from Bronze Age settlement and are not particularly associated with clusters. For example, at Gransha Co. Derry, Early to Middle Bronze Age burnt mound activity was identified within 600m of known Middle Bronze Age settlement evidence at Lough Enagh. At Killoteran, Co. Waterford (WD16), Early and Middle Bronze Age burnt mounds were situated at a distance of 700m from Middle to Late Bronze Age habitation at Adamstown 1 and Adamstown 3 (Eogan and Shee-twohig 2011). An Early Bronze Age structure and associated stake-holes and pits at Jordanstown 1 is located *c.*750m to the south-east of Jordanstown 3, also dating to the Early Bronze Age.

Additionally, a Middle Iron Age date has been returned for a shallow pit at the site indicating the site had a number of phases of occupation (Brick 2012). At Kilmacahill 2, Co. Kilkenny *c.*1km to the south-west, several groups of postholes and stake-holes may represent temporary structures. A further pit was identified at the centre of the site, which contained a significant amount of Early Bronze Age pottery. Dates returned from the site indicate Early Neolithic activity, as well as Early, Middle and Late Bronze Age activity, suggesting a continuity of site use in prehistory (*ibid.*).

At Garryduff 1, Co. Kilkenny, an external ring of 37 postholes and stake-holes in a shallow, curving slot-trench enclosed an area 11m in diameter, with an inner ring of 10 larger postholes 7m in diameter. This structure was located on the edge of a slopethat leads down to an adjacent river. Six kilometres to the north of Garryduff 1 there was an oval-shaped structure at Shankill 4, located 900m from a recorded burnt mound site. This was a small structure that consisted of post-holes, stake-holes, an internal hearth, and outlying pits. Sherds from domestic cordoned urn pottery were also found. At Ballyquirk 2, Co. Kilkenny, an Early Bronze Age settlement was identified. A range of features including circular arrangements of posts and stakes indicate that this was likely to be the focus of a semi-permanent domestic settlement. At Ballyquirk 3 similar activity was identified, dated to the Middle Bronze Age, although not as extensive as at Ballyquirk 2. The relationship between these sites and the cluster of burnt mounds at Ballyquirk 4 (KK32; KK33a-c) is tentative as further burnt mound sites could lie outside the road corridor, closer to these settlement locales.

Problems of site contemporaneity

While many burnt mounds occur in close association with settlement sites, GIS analysis indicates that some Bronze Age settlements had no pyrolithic deposits in the immediate vicinity. Similarly, there are also areas where many burnt mounds are situated but with very little evidence of nearby settlement activity. This was the case along several road development projects such as the N25 Charlestown Bypass, the N5 Ballaghaderreen Bypass, the N11 Rathnew to Arklow Road Improvement Scheme, and the N6 Kilbeggan to Athlone Duel Carriageway. The bias of the schemes towards lower marginal ground for design purposes may explain why associated habitation sites were not identified. For example, archaeological investigation along the Westport Main Drainage Scheme uncovered several burnt mounds, many of which were constructed over several metres of peat to access underlying water-tables. The only prehistoric structures identified were located in upslope locations, above this marginal ground on relatively dry, free draining soil above the wetter areas (Gillespie 2001). Similar circumstances may apply to other developments in Mayo and Roscommon. The landscape of the N5 Ballaghderreen Bypass is undulating and the present road scheme passes through the Lung River Valley. The surrounding topography of the scheme comprises undulating bog land drained by small water courses ideal for pyrolithic processes. Many of the burnt mounds excavated along the N25 Charlestown Bypass were found within peat near the eastern edge of a shallow east/west peat basin that was bounded to the north by low gravel hills. Such a low-lying topographic position may explain why no Bronze Age habitation areas were revealed during road construction.

These apparent gaps in site distribution probably reflect the different routes that infrastructure projects may take, and the accompanying limitations on archaeological investigations. For instance, where many burnt mound deposits are identified in a particular location, with no evidence of nearby settlement, this may be explained by the low-lying nature of the corridor route. Moreover, the immediate area may not have been suitable for habitation, which was probably located on adjacent better-drained ground. It should also be acknowledged that potential habitation areas may lie outside exposed areas investigated along these road corridors. Larger assemblages of material culture found at some pyrolithic sites suggests settlement activity in the immediate vicinity. Similarly, where settlement sites have been found with no direct evidence of nearby pyrolithic activity, this may reflect the topographical location of a particular road or pipeline route, where the area is not be suitable for pyrolithic water-boiling. It is, of course, possible that unrecorded, levelled sites may lie outside the areas revealed by the road or pipeline corridor.

Burnt mounds, particularly clusters of sites, have a high archaeological visibility due to the presence of surface dump deposits that accrued from their use. Unfortunately, as outlined in Chapter 4, their distribution today has been adversely effected by land use practices, agricultural activity and environmental change in later periods. Caution is required when interpreting what are essentially maps of archaeological discovery. It is possible that many more burnt mound deposits were located closer to settlements, but remain undetected. Indeed, even when burnt mounds occur in close proximity to habitation areas it can be difficult to understand the relationship between the two areas of activity, particularly when attempting to prove contemporaneity between sites that are not stratigraphically related and where independent dating is lacking. This was the case at Curraheen 3, Co. Cork (CO84), where the remains of a burnt spread dated to the early medieval period was identified 230m east-north-east of a Late Bronze Age structure (Hurley 2008). As the medieval sample is problematic and full extent of the burnt spread was not revealed, it is impossible to know if they are both contemporary. The same set of circumstances was identified at Knockaunkennedy, Co. Tipperary (TY19), where the 'medieval' burnt mound was located within 1km of Middle Bronze Age settlement activity. As this charcoal represented later activity at the burnt mound, it remains unclear whether the two sites are related.

At other sites, it is common that while areas of Bronze Age settlement are often well dated, the age of nearby burnt mound deposits is not known. This was the case at Tinryland, Co. Carlow (CW07), where a burnt mound located 700m from a Middle Bronze Age settlement was not scientifically dated, even though it showed obvious signs of multi-period use with a number of timber-lined troughs. It is also unfortunate that many sites with complex use-histories are dated by single radiocarbon determinations, that do not give a true representation of site chronology (see Chapter 5 for further discussion). This was evident at Rathcrougue, Co. Carlow (CW08), where a single Early Bronze Age radiocarbon date was obtained from a site with Middle to Late Bronze Age features located 700m from contemporary settlement.

Because of the incomplete nature of these distributions and the lack of well-dated sites, it is not possible to identify clear chronological trends in the dispersal of the prehistoric communities who produced these deposits. It is important to reiterate that the known distribution of both burnt mounds and contemporary settlements in Ireland is not representative of the total number used in the prehistoric period.

7.3 BURNT MOUNDS AS DOMESTIC SPACE

Defining the spatial limits of a settlement is a difficult task and the significance of residential mobility and interaction with the wider landscape must be considered. The available evidence suggests that the great majority of burnt mound locations were open-air sites that were not defined by formal boundaries or enclosures (see Chapter 4). Bronze Age settlements, on the other hand, particularly those with an enclosing element, are often viewed as discrete entities with little reference to the surrounding landscape. That said, a number of activities would have been undertaken outside the visible boundaries of a site, however, these are not archaeologically visible due to the partial investigation of these sites in developer-funded projects.

A good example of a Bronze Age settlement landscape is preserved on Dartmoor in south-west England. Fleming (2008) argues that those communities were organised in ‘neighbourhood groups’, possibly based on extended families that together lived and worked on the land. Brück and Fokkens (2013) observed that this is comparable to what is visualized for the organisation of landscape in ‘local communities’, namely groups of people who worked the same fields, shared neighbourhood obligations and resources such as harvesting, building of houses, and the use of teams of oxen. Therefore, the question remains whether burnt mounds were part of the domestic space of an individual family or were integrated within a larger shared communal space.

Ó Néill (2009) observed that if contemporary houses were located more than 1.5km from burnt mounds, it is unlikely that even a large-scale development might identify those structures, even if it was possible to produce definitive evidence of such a relationship. Even a 2km walk would take a mere 30 minutes and if burnt mounds are located at such a remove, it may be the case that the distance from a house site is a reflection of a broader settlement pattern. This is where burnt mounds were at a comfortable walking distance from a number of houses rather than one group. This would suggest that their use had a social function beyond the needs of an individual settlement or house site (Chapter 6). That said, recent evidence suggests that pyrolithic deposits relating to burnt mound activity can occur close to permanent domestic dwellings. For example, 43 excavated sites have been identified within 100–200m of Bronze Age settlement structures. This does not include smaller structures discussed previously, relating to possible specialised activity. Other stone-built structures such as those found at Drombeg, Co Cork (CO07), Coarhamore, Co. Kerry (CO03), and Garranes, Co. Cork (CO57), may also relate to non-domestic processes.

Brück (2006: 298) observed that most Bronze Age settlements were occupied by a single household group. The presence of more than one roundhouse can be explained through evidence for the spatial differentiation of activities, with each site containing a main residential building plus one or more special-purpose structures used; for example, for food preparation and storage, specific craft activities, or animal stalling. By extension, burnt mound sites within the immediate domestic space of a permanent settlement may have served one particular family or kin group, operating at a familiar social scale for cooking, where the location was ideally suited for permanent habitation and pyrolithic technology. Their size suggests that they were the focus of relatively small groups and may have provided the context for gatherings of kin and neighbours to prepare and share food as part of a regular social round. This may have been the case at Bun, Co. Cavan (CN14); Cloghers, Co. Kerry (KY04); Raheenagurren West, Co. Wexford (WX21); Prumplestown Lower, Co. Kildare (KD38); Caltragh, Co. Sligo (SO14); Kilulla, Co. Clare (CE05–09), and Clonmore North, Co. Tipperary (TY34). At the latter site, the Middle Bronze Age burnt mound was located in close proximity to three contemporary structures, two of which were substantial and likely to have been used for habitation (McQuade *et al.* 2009: 121; Figure 7.6). A similar set of circumstances were identified at Caltragh, Co. Sligo (SO14), where contemporary burnt mound activity was identified in close association with three large Middle Bronze Age houses (Danaher 2007: 40).

In a study of Bronze Age settlements, Cleary (2007: 113) considered the possibility that burnt mounds may relate to a more elaborate type of ‘external hearth’. She recorded burnt mound activity within 1–300m of at least twelve sites; however, the structures at some of these sites cannot be confirmed as residential in nature. In spite of this, Cleary maintained that pyrolithic locations would have been a significant element in the layout of the settlement, ‘possibly representing a meeting place similar to the external hearths of the Bamagwato and Basarwa tribes of Serowe, Botswana, where a variety of activities may

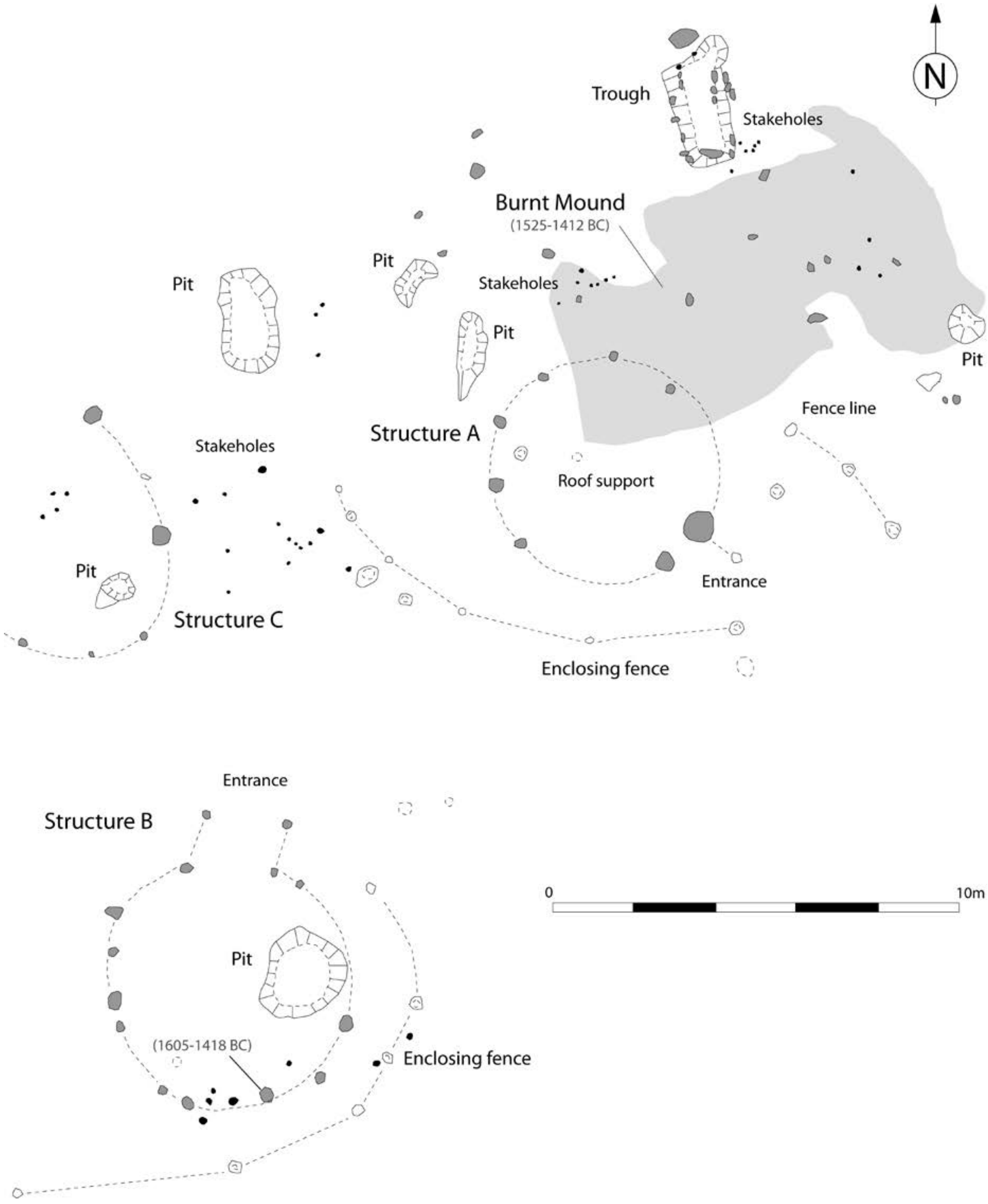

Figure 7.6. Bronze Age burnt mound and structures at Clonmore North, Co. Tipperary. Source: adapted from McQuade *et al.* 2009

have taken place, related both to the sacred and profane' (2007: 212). In this scenario, burnt mounds functioned as outlying areas of temporary occupation associated with more permanent settlement.

In this way they were part of local settlement patterns, and in the areas where these sites are common their distribution supports a model of distinctive identities at a local or familial level. This evidence suggests that burnt mounds may have been the local feasting sites used in rounds of social feasting and bonding among neighbouring families.

As observed by Dewar and McBride (1992: 229) in relation to settlement patterns, 'the distribution of archaeological materials across a landscape is almost always a product of many years and even generations of use'. This could

include burnt mounds that may not necessarily reflect an articulation of a typical seasonal round with permanent landscape features, but rather many years of the establishment and abandonment of residential occupations on a landscape, some of whose features altered over time in response to previous use. It is important to acknowledge that the evidence of preceding pyrolithic activity must have influenced in some way that which followed it. A history of previous use may have been important in site selection as it would have signalled the area was suitable for pyrolithc water-boiling. These locations may also be redolent with 'memories' of past social occasions involving feasting (see below). As observed in Chapter 6, the clustering of sites within settlement space may reflect these lineage ties and kin relationships within a specific territory. The mounding of burnt stone may be linked to memory and the creation of place. In constructing a mound from the debris of the firing, rather than disposing of the material in discrete spreads practitioners were both drawing attention to the site and creating a sense of place (Doughton 2012: 42). The role of burnt mounds in creating and maintaining memories of past activity can be seen at Clowanstown, Co. Meath (MH82). Several aspects of possible commemoration were recorded at the site, interpreted as 'decommissioning' activities. This included the deposition of a wooden container into the mound and the monumentalising of the site using spreads of burnt material, unburnt stone and inclusions of cremated animal bone, lithic material and several animal skulls (Mossop 2008).

The clustering of burnt mounds near contemporary habitation may also represent some expressions of territorial identity, symbolised in the mounding of waste material in close proximity. As Renfrew (1976) observed 'human behaviour is territorially organised and that all past societies have a spatial structure which in some way reflects their social organisation. In a discussion of megalithic tombs in Britain, Bradley suggests that by building long-lasting monuments in a working environment, people might have laid claim to certain resources (1993: 6). The place where food is prepared and waste disposed of may also relate to the position, orientation and status of adjacent dwellings (Jones 2013: 55). Seasonal variation may also contribute to changes in land rights where certain troughs were only accessed at particular times of the year due to water-levels. Brück (2001: 13) has explored this notion in relation to Bronze Age settlement and crop rotation. For example, when fields are in cultivation they 'belong' to those who have planted them. However, when the same fields are in fallow they may be used for the whole community for grazing. In this way, it may be appropriate to view burnt mound clusters as part of a system of socially recognised claims to valuable resources such as fresh water, firewood and stones for water-boiling. The use of stone for hearths and trough linings during the Middle to Late Bronze Age may have given some sites a degree of permanency, symbolising the ties between certain extended families or communities and places in the landscape (Jones 2013: 70). The act of deliberately depositing artefacts in some older burnt mounds as part of 'closing ceremonies', followed by the beginning of a new pyrolithic site nearby, were physical reminders of the continuity of settlement and the lasting bonds between ancestors and land. The clustering of burnt mounds may reflect lineage ties and kin relationships within a specific territory, and possibly a lineage relationship where adjacent burnt mounds are linked to different family branches. It is reasonable to assume that the spatial arrangement of burnt mounds corresponds to the home areas of living groups of people. This assumption is supported by the spacing of these sites across Ireland and their occurrence close to areas with the most production resources. This, however, is not to exclude their use by extended communities.

The re-visiting of burnt mounds and the re-use of specific troughs may have been a way of adhering to tradition and maintaining links with the past. The re-lining of older troughs shows that these sites were a permanent entity in the landscape, even if the use of these sites was not an everyday occurrence. This suggests there was a continuing social memory of the history of these places before. In other words, events at burnt mounds may have been shaped by a blend of traditions associated with that particular place, and a localised understanding of what the site meant originally. By re-establishing a trough and adding new waste stone to an existing burnt mound, the intention may have been to enhance a landscape feature that was already believed to be an ancient site, perhaps thought to have been created by their ancestors (Bradley 2002: 8). Re-lining and re-cutting of troughs within the footprints of earlier examples could even be linked to genealogical associations linked to previous inhabitation of that area. It may have been these previous events that made burnt mounds suitable focal points for activity in the late periods. This pattern of re-use and persistent remarking of an important place is consistent with evidence from many burnt mounds in Ireland that show periodic modification over time (see Chapter 5). Their immediate separation from residential settlement was partially influenced by the processes involved, which posed a fire risk to nearby timber structures and created large amounts of smoke in habitation areas. It must be acknowledged, however, that such practical considerations may also have been symbolically charged. In this sense any practical action is also symbolic because it reproduces the sets of values and social relations that are embedded in cosmological schemes (Brück 2001: 62). As trough locations were marked by an accumulation of burnt stone, these mounds had an influence on the way people moved around settlement space. It is clear that the sites functioned as components within a collective facility to be used when required. Some of these actions became very ingrained and long-lived, with examples of long-held practices involving pyrolithic technology from the fourth to the first millennia BC. This need not equate with continuity of belief or conscious planning, but rather with the appropriate 'action' to be undertaken in given circumstances. It must be remembered, however, that not all burnt mounds were continuously used over long periods of time, with some individual sites having extremely short periods of use. The

continued use of pyrolithic technology over a wide area, however, is likely to be long-lived, because they were not 'spectacular' actions open to contestation but were part of dwelling in the landscape and a sense of attachment to place. Through repetitive occupations and engagements with certain places, people created myths and genealogies that embedded themselves into the spaces they occupied, and structured the ways in which the word around them was inhabited (Jones 2013: 71).

As observed in Chapter 6, it is difficult to make a clear separation of 'ritual' from 'non-ritual' in relation to burnt mounds and other sites in Bronze Age Ireland. If viewed as part of the domestic space of contemporary settlements, it could be argued that burnt mounds mainly functioned as domestic cooking sites. This may be supported by the recovery of domestic artefacts from these sites in recent years (Chapter 6; see below). Bradley (2003: 20) argues that ritualization was a process that affected many components of domestic life. Among many peoples, ritual is an integrated part of day-to-day existence and what we routinely identify as 'ritual' acts are in reality practical activities of everyday living. In this way, ritual practice is not always spatially, temporally or conceptually distinct from day-to-day activities (Brück and Goodman 2001). For example, the primary activities carried out in any home or settlement include sleeping, cooking and daily chores, all of which are viewed as defining features of 'domestic' life. Such activities, however, serve essential roles in creating and maintaining social relations, and the same can be said for burnt mounds. Furthermore, all settlements, and by extension burnt mounds had particular religious observances and household rituals, which are very occasionally visible in the archaeological record. This is where everyday acts took on special significance, where people ritualised particular aspects of their daily lives, providing them with added meaning (Bradley 2005; Tilley 1996). The social role of burnt mounds may therefore have extended to provide a venue for ceremonial events where ritualised feasting took place at particular times of the year.

The close association between settlement, mortuary practice and burnt mounds combines the activities of the living and the dead, and helped to create a strongly localised sense of self. Cooney and Grogan (1994: 141) proposed that burnt mounds may be part of an integrated system including domestic and burial sites. A possible example is Drombeg, Co. Cork, where the water-boiling area was connected directly to a hut-site adjacent to a contemporary stone circle. This is also evident in south Co. Limerick, where a complex landscape organisation with extensive cemeteries, domestic sites and burnt mounds form an integral pattern (Cooney and Grogan 1994: 141). That was confirmed during other recent infrastructure developments where burnt mounds were found close to contemporary Bronze Age burial sites or cremation cemeteries, such as Williamstown, Co. Westmeath (WM09), Clonmelsh, Co. Carlow (CW09), Rathpatrick, Co. Kilkenny (KK19), and Graigueshoneen, Co. Waterford (WD07). In North Munster, burnt mounds are clustered in areas where other potentially contemporary sites occur, such as standing stones, habitation enclosures and hilltop enclosures, which all formed part of local settlement patterns (Grogan 2005: 138). The spatial association of many burnt mounds with stone circles (Fahy 1960; Murphy 2009; Hogan 2009; Grogan 2005) and other ritual monuments, such as barrows and standing stones in later periods of the Bronze Age is also noteworthy. Connolly (2001) suggested that spreads of heat-shattered stone at Darragh, Co. Clare, and at various sites in Co. Kerry, are spatially related to other monuments in the wider area, and in particular to embanked enclosures, representing alternative or secondary functions relating to ritual activities. However, as Bradley (2007: 216) observed, this does not mean that burnt mounds themselves were used for mortuary rituals, particularly as human remains are very rarely found at these locations. Rather, it suggests that they were located in places where such activities took place. This illustration of the wider use of a landscape further emphasizes that our current perception of Bronze Age settlements is the minimum space utilised by the people living there. Renfrew (1981) observed how sacred space may correlate completely with secular space, so that the individuals forming a local group would be buried together just as they lived. This strongly suggests that features of ritual actions were shared by the secular and were not mutually exclusive. Clark (1977) observed that most food in a subsistence economy will be obtained within an hour or so of a core settlement, and this is also likely to be true for the disposal of the dead.

7.4 MATERIAL CULTURE AND DEPOSITIONAL PRACTICES

Some burnt mounds have a complex use history, marked by continual discarding of burnt stone, often over considerable periods of time and sometimes between long periods of inactivity. This complex history was in many cases punctuated by episodes of disturbance involving both human and natural agencies (see Chapter 3). The archaeological record is a palimpsest of repeated activity and as already identified, stratigraphic resolution of burnt mounds is an acknowledged problem as most survive as dispersed spreads of heat-shattered stone, leaving many artefacts unstratified.

While Irish burnt mounds produce little in the way of cultural material (Cherry 1990), recent excavations have recorded a range of artefacts and environmental material from all periods (Figure 7.7). The interpretation of these finds depends on their character, context and dating. It is not surprising given their visibility in the landscape that many burnt mounds contain later objects in upper levels. Fragments of glass, iron and early modern pottery, in particular, are usually interpreted as domestic refuse that found its way onto the site through later ploughing, manuring or the digging of drains. In rare cases, however, such as at Crabbsland, Co. Limerick (LK19), Ballyman, Co. Dublin (DN01), and Tullahedy, Co. Tipperary (TY27), material derived from medieval industrial activity on the site had no connection to earlier pyrolithic activity (see Chapters 7 and 9).

Artefact type	sites	Topsoil	Burnt Mound	Trough	Pit fill	Hearth	Well fill	Adjacent to site	Unknown context	Other
Wooden implements	11	-	4	3	2	-	1	1	-	-
Worked bone/ antler	11	-	5	1	4	-	-	-	-	2
Leather fragments	1	-	-	1	-	-	-	-	-	-
Lithics (flaked stone)	268	See below	See below	See below	See below	See below	See below	See below	See below	See below
Hammerstones	20	2	10	2	2	1	-	-	-	3
Pounders	3	-	6	1	-	-	-	-	-	-
Rubbing stones	8	-	7	-	2	-	-	-	-	-
Grinding stones	3	1	4	-	-	-	-	-	-	-
Saddle querns	18	2	5	5	1	1	1	1	1	1
Spindle whorls	7	1	2	2	1	-	-	-	-	1
Stone discs	7	-	2	-	2	1	-	-	-	2
Stone beads	3	1	3	-	1	-	-	-	-	1
Pestle Stone	2	-	1	1	-	-	-	-	-	-
Shale/lignite bracelet	3	-	1	1	-	-	-	-	-	1
Amber beads	4	1	1	-	1	-		-	1	-
Metal axeheads	5	3	1	-	-	-	1	-	-	-
Copper/bronze pins	6	-	2	1	1	-	1	-	-	1
Metal beads	1	-	-	1	-	-	-	-	-	-
Gold objects	5	-	1	2	-	-	-	1	-	-
Prehistoric Pottery	40	1	12	2	10	-	-	2	-	15
Clay objects	2	-	-	2	-	-	-	-	-	-
Whetstones	16	3	11	3	3	-	-	-	-	-
Anvil Stone	1	-	-	-	1	-	-	-	-	-
Macehead (?)	1	-	1	-	-	-	-	-	-	-
Stone Axes	18	9	6	-	-	-	-	1	-	2
Barbed and tanged arrowhead	15	1	7	-	3	-	-	-	-	4
Hollow-based arrowhead	4	2	2	-	-	-	-	-	-	-
Leaf-shaped arrowhead	4	1	2	-	-	-	-	-	-	1
Plano-convex Knife	4	2	1	1	-	-	-	-	-	-
Scrapers	83	12	45	5	14	1	-	-	-	27
Blades	38	10	25	1	3	-	-	-	-	2
Cores	23	10	12	1	1	-	-	-	-	7
Total	631	72	187	36	52	7	4	6	2	68

Figure 7.7. Types of artefacts from burnt mound contexts in Ireland.

Prehistoric artefacts are now commonly found in burnt mound excavations (Appendix 1: Figure 10.11). Prior to the application of radiocarbon methods, the dating of individual burnt mounds was dependent on the recovery of artefacts such as at Ballycroghan, Co. Down (DW01), Webbsborough, Co. Kilkenny (NC) and Clonkerdon, Co. Waterford (WD01) (Hodges 1955; Prendergast 1955; Quinlan 1885–6). The interpretation of artefacts from burnt stone deposits can be problematic due to their poor dating and contextual ambiguity (see Chapter 5). Few come from what could be described as closed contexts, where independent dating can be established through radiocarbon dating or secure association with other archaeological material. One way of attempting to work out the association between artefacts and burnt mound lifecycles is to explore the implications of formation processes, particularly when trying to clarify whether the finds recovered are contemporary with the sites 'occupation'. As observed by Schiffer (1987: 200), sites interact with and are affected by their surroundings, through both natural or environmental and cultural process. Specifically relevant to burnt mounds is an understanding of how these deposits deteriorate over time through later ploughing and how this process can affect the recovery of material culture (see Chapter 3).

As outlined in Chapter 5, this study reveals how 375 sites excavated from 1950–2010, representing 35% of all these excavated, have produced artefacts. These consist mainly of flaked stone tools, followed by coarse stone assemblages and pottery. These are the type of discarded objects commonly found in domestic settlement contexts in prehistoric Ireland and is further evidence that burnt mounds were an integral part of a local settled landscape.

Figure 7.6 shows the contexts of finds recovered from burnt mounds and related pyrolithic deposits. The totals presented are not the true total sites, as one site could have several types of artefacts. The columns are totalled simply to provide indices as to which contexts are the most abundant sources of finds. The items found outside the mound are probably less secure in their association with pyrolithic activity than those from other contexts. The most significant contexts are the mound itself, and then related features such as troughs and pits.

Flaked stone tools remain the most common material found from burnt mounds with 268 sites producing small flaked assemblages usually composed of flint or chert (Figure 7.8 and Figure 7.9). This is followed by coarse stone assemblages, consisting of hammerstones, pounders, rubbing stones, grinding stones, hones/whetstones, morters and pestles, found at 51 excavated sites (Figure 7.12). These are generally poor chronological indicators, whose dating relies to a large degree on their association with more accurately dated finds or associated radiocarbon dates. The occurrence of more diagnostic tools, such as saddle querns and spindle whorls, suggests a spatial association with nearby agricultural settlements. A total of 18 saddle querns were recovered from burnt mounds in Ireland, with the majority either from burnt mound material or trough fills

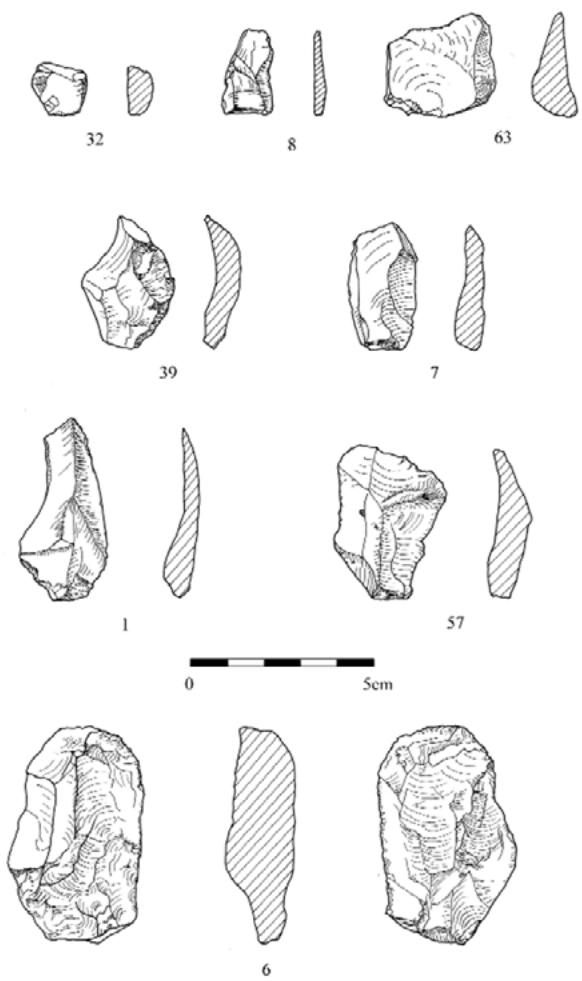

Figure 7.8. Selection of Bronze Age lithics from Coolroe, Co. Mayo. Source: Richard Gillespie, Mayo County Council.

dating to the Middle to Late Bronze Age (Figure 7.11). Examples from Holdenstown, Co. Kilkenny (KK37), Killoran Co. Tipperary (TY01), Charlesland Co. Wicklow (WW23), Graigueshoneen, Co. Waterford (WD07), and Kellymount 3, Co. Kilkenny (KK57), were found at sites located within 1km of known settlements (Figure 7.14). Saddle querns were mainly used for grinding grain or other domestic purposes. Seven spindle whorls and seven stone discs were recovered from burnt mounds in Ireland. Their use at these locations remains unknown.

Pottery was found at 40 burnt mound sites in Ireland, but only in a relatively few cases is it possible to identify a specific type due to poor survival. Shards from broken vessels were recovered from both burnt mounds, troughs, pits and other related features, with the majority coming from mound deposits and related pits (Figure 7.10). The material includes sherds of Neolithic carinated ware from Clowanstown 1, Co. Meath (MH82), and Cherryville 7, Co. Kildare (KD09). Beaker pottery is recorded from sites such as Ballyvollane, Co. Limerick (LK25), Ask Co. Wexford

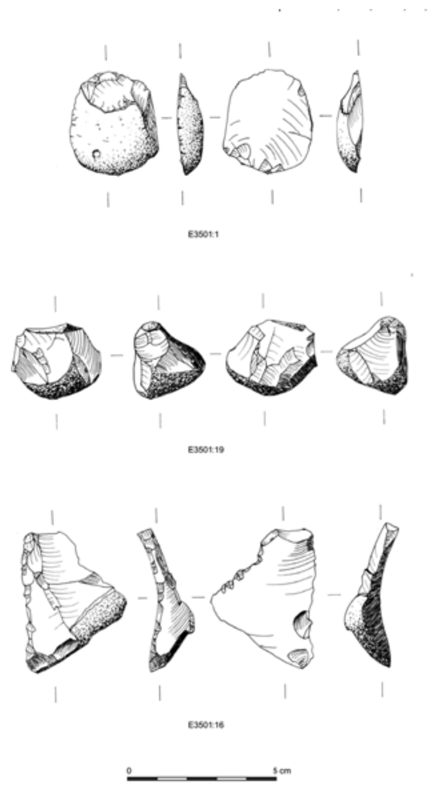

Figure 7.9. Lithic finds from Ask (SITE 41), Co. Wexford. Source: VJK Ltd

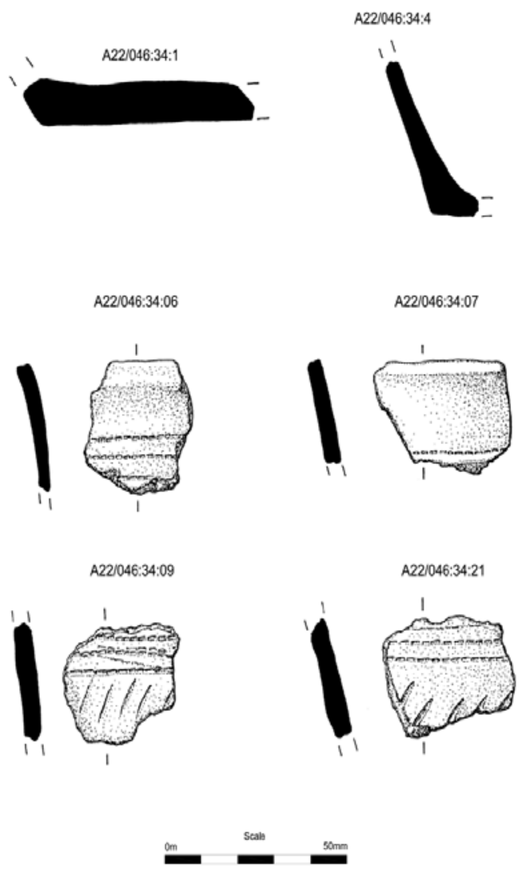

Figure 7.10. Beaker pottery sherds from Ballyclogh North, Co. Wicklow. Source: IAC Ltd.

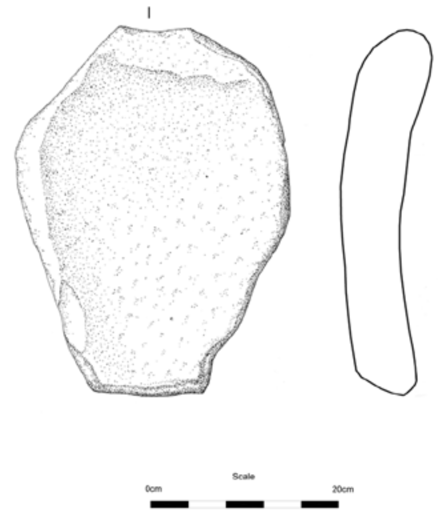

Figure 7.11. Saddle Quern from Monreagh, Co. Galway. Source: IAC Ltd

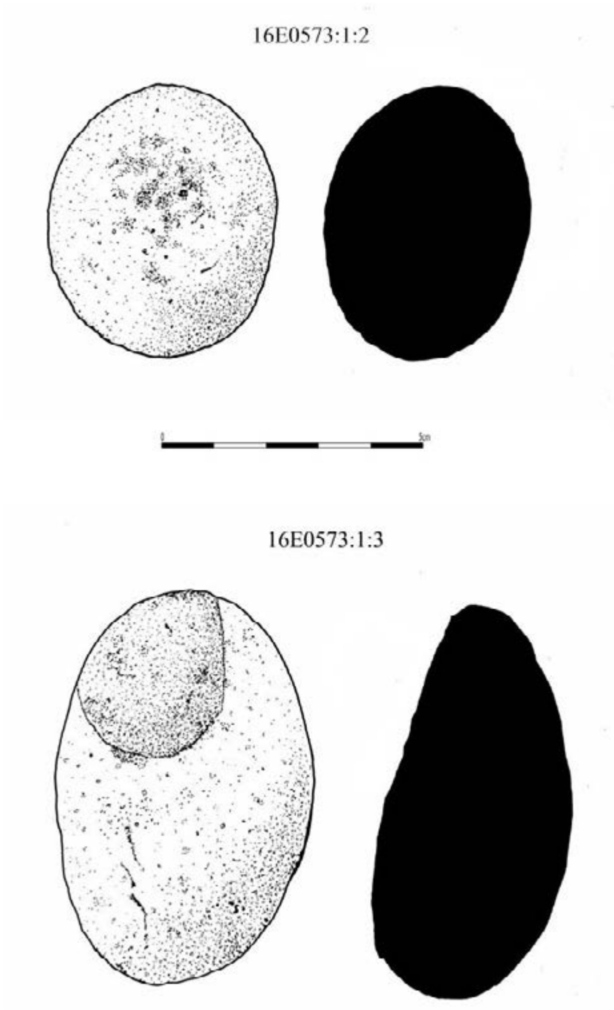

Figure 7.12 Possible hammerstones from Errarooey More, Co. Donegal. Source: Seán Sharpe

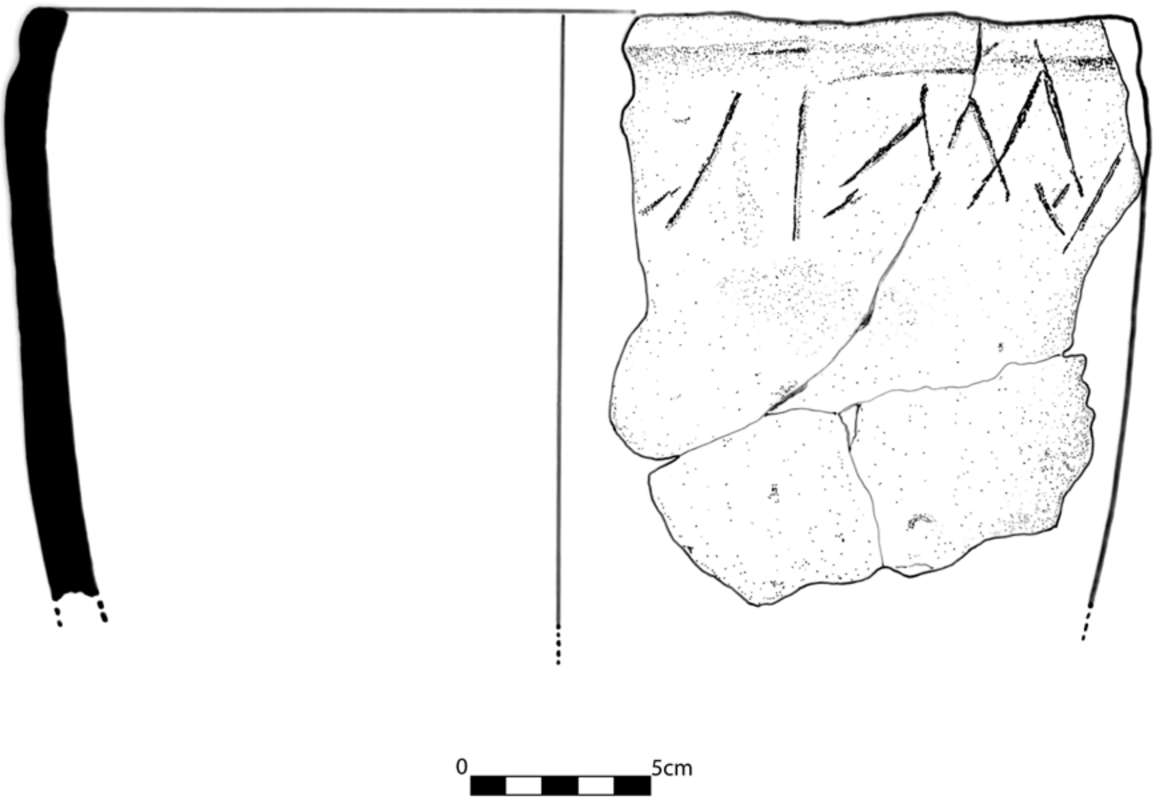

Figure 7.13. Decorated pottery from a large bucket-shaped vessel recovered from a burnt mound at Strandfield, Co. Wexford. Source: Rose Cleary, UCC.

(WX05), and Ahanaglogh, Co. Waterford (WD03). Bronze Age coarseware is recorded from Bun, Co. Cavan (CN14), Strandsfield, Co. Wexford (WX03; Figure 7.13), Lecarrow, Co. Mayo (MO03), and Coarhamore, Co. Kerry (KY03), all confirmed by radiocarbon evidence. Possible funerary pottery has also been recovered from burnt mound deposits. At Clogh, Co. Wexford (WX10), a sherd of Early Bronze Age encrusted urn found in the fill of a pit is broadly contemporary with a radiocarbon date. A sherd of similar pottery was recovered from a site at Roscath, Co. Wicklow (WW51). It must be stated, however, that the pottery from these sites could be domestic versions of urn pottery as it does not occur in a burial context. Similar to other more diagnostic material culture, this material is often found in sites in close proximity to nearby settlement, such as Bun, Co. Cavan (CN14), Tinryland, Co. Carlow (CW07), Cherrywood, Co. Dublin (DN05), Laughanstown Co. Dublin (DN16), Prumplestown, Co. Kildare (KD17), Clonmore North, Co. Tipperary (TY34), Knockaun, Co. Clare (CE08), and Kilmainham, Co. Meath.

Most material culture recovered in burnt mounds appears to be residual or secondary 'rubbish', discarded or lost and subsequently incorporated into the archaeological record. As mentioned previously, some artefacts pre-date pyrolithic processes on site, while others relate to later activity. Some contexts and artefacts recovered are generally referred to as 'odd' deposits (Brück 1999: 152). These usually come from troughs, well pits and burnt mounds, where the condition or arrangement of the artefact is often as important as the type of object utilised or the material culture it is associated with (Figure 7.14; see Chapter 7). These 'odd' deposits could in some instances be related to 'closing events' comparable to those associated with Bronze Age houses (Brück 1999; Cleary 2006). These types of events may also account for the deposition of broken or decommissioned artefacts, animal and human remains, symbolic of the end of one life cycle and the beginning of another (Cleary 2007: 276).

Deliberate deposition

Deposition may have taken place at important stages in the life cycle of both settlements and related burnt mounds. It is probable that the abandonment of some burnt mounds were marked in some way, possibly including the deposition of 'special objects'. Other important events represented in burnt mound use and deposits might include particular births, seasonal changes, deaths of leaders, and marriages or the creation of social relations (Cleary 2006:

34). Similar to ideas proposed for settlement sites, the deliberate deposition of the remains of ancestors in troughs and burnt mounds may have symbolically tied the living to the land their kin once inhabited, while also ensuring good fortune for the living (*ibid*.: 32). These artefacts may not have been at the end of their use-life but may have marked out specific places, events or ideas.

Human remains have been recorded from 17 burnt mounds in Ireland (2% of excavated sites), four of which have been interpreted as deliberate deposits. Their presence as 'closing deposits' in burnt mounds may relate to death pollution, particularly if the deceased had died at the site (see Cleary 2006). It may have been a (very occasional) practice to 'close' a burnt mound where a death had taken place, by depositing some of the remains of the deceased. The inclusion of human remains in areas connected to pyrolithic technology may represent an additional link between burnt mounds and nearby settlement sites. These areas were important socially, representing significant places in which people engaged in different forms of social reproduction and the transfer of knowledge through the medium of cooking (Chapter 6). Therefore, the occasional incorporation of human remains or other artefacts may have been a way of 'maintaining the household's subsistence cycle and social relations that sustained this' (Brück 1999: 154). The use of marginal locations, such as burnt mounds, for deposition may have been a way of reinforcing the connection between these areas and settlements. The fact that some human bone deposits were found in wells or springs suggest another possible relationship with water and burnt mounds and its importance for pyrolithic water-boiling. Nowhere is this more evident than at Inchagreenoge, Co. Limerick (LK45), where a human skull was deliberately deposited in the base of an adjacent spring and sealed with several capping stones (Figure 6.25). Similarly at Ballynakelly, Co. Dublin, a palstave and bundles of wood appear to have been deliberately and consciously deposited in a well after the water heating activity had ceased at the site. The deposition of votive offerings in watery places can in some ways be seen to share a characteristic with grave goods in that they were not intended to be retrieved (Bradley 1990: 94). They may have had a number of different connotations to either an individual or larger community ranging from rites of passage to gifts to the gods or supernatural entities. The fact that the palstave at Ballynakelly was unused may imply it was intentionally created as a ceremonial object, possibly solely to be deposited in the well.

It is possible that the other objects deposited were curated items connected with certain events, people or places (Harris 2009), and that they were repeatedly brought together to a specific place in the landscape. The occurrence of various stone tools, pottery and saddle querns would suggest the use of 'mundane' artefacts in a more symbolic way, as would the use of faunal remains. This may imply a concern with everyday living, particularly the importance of sustained subsistence, such as the prosperity of crops and animals. It is also likely that some artefacts entered burnt mound contexts through practices that had become 'ritualised' through routine practice, rather than as explicit acts of 'ritual' such as those undertaken at ceremonial monuments. The infilling of troughs and the deposition of domestic material culture may have formed part of a widely held ideology concerned with making an appropriate offering or with marking the occupation of a place in a particular way, part of a long-held tradition of inhabitation of the landscape (Jones 2013: 62). The formal deposition of artefacts and human remains is still a rarity at excavated burnt mounds and it may have only been under special circumstances that pit digging and infilling became a an overtly ritual act. However, the incidence of each type of object is very low relative to the total number of excavated sites.

Figure 7.14. Late Bronze Age gold bracelet and two folded pieces from burnt mound at Ballymaclode, Co. Waterford. Source: Judith Carroll and Company.

Taken as a whole, the surviving and identifiable evidence for votive occurrences at burnt mounds is roughly comparable to similar occasional activity at habitation sites both in form and frequency. The evidence from burnt mounds differs in composition from the votive offerings known from natural places (Bradley 2000). In the case of burnt mounds and habitation sites, the similarities represented, suggests that people viewed these aspects of the contemporary landscape in much the same way.

7.5 Landscape Context: Burnt Mounds and Prehistoric Settlement

The choice of a particular site for pyrolithic processes may have been determined by a number of factors that operated collectively or independently. Firstly, some natural areas may have been deemed sacred by virtue of an earlier ritual association, while others were significant in relation to earlier pyrolithic processes connected with an ancestral history. Secondly, the choice of a particular location may have been influenced by the availability of water, fuel and stone. All pyrolithic sites, however, were probably influenced by the territorial extent of a specific social group.

There is no evidence from the available archaeological record to suggest that certain locales were regarded as sacred or ritual places prior to their use for pyrolithic water-boiling. This could be argued that the gold and tin artefacts recovered from below trough timbers at Killeens, Co. Cork (CO05) and Sonnagh, Co. Mayo (MO52), but those finds are best viewed as a form of 'foundation deposit'. These objects were found in the primary trough cut and so could not pre-date the burnt mound, unless they were residual finds. While finds of Mesolithic and Neolithic stone tools may pre-date the use of certain mounds, they cannot be tied to any ritual use of these areas and probably relate to the opportunist use of wetland areas where burnt mounds typically occur. Possibly of greater relevance, however, was the association of a particular place with an ancestral past, where the action of past pyrolithic activities sanctified that place. This is supported by the tight clustering of burnt mounds of different ages in particular locations, and by the re-use of burnt mounds after long periods of abandonment. Yates and Bradley have considered the location of Bronze Age hoards and burnt mounds of the same period in parts of Hampshire, Sussex, Surrey and Kent. They conclude that it is difficult to confirm whether hoard deposition was a purely 'practical' one. In these parts of Britain these deposits seem to exhibit a recurrent association with fresh water and with springs, pools, streams, rivers and confluences. In some instances they were placed on small areas of higher ground overlooking these features, while others were located near to burnt mounds or coaxial field systems (Yates and Bradley 2010: 26).

When considering burnt mounds, there is the question as to how their location and environmental resources relate to the original environment of their use. This is complicated by the various transformations that the natural environment has undergone since those pyrolithic sites were abandoned. These relate to changing human use and environmental factors, chiefly the drainage of wetland areas and reclamation of agricultural land. A useful approach is to examine burnt mound locations in respect of particular aspects of the natural environment (geology, topography, soils, drainage) or in relation to the physical landscape as a whole. It is likely that the suitability of a location for pyrolithic processes (availability of water, fuel and stone) was the primary 'pull' factor influencing site location (Figure 7.15). Studies relating to burnt mounds often concentrate on wood species recovered, possibly because of the dating evidence that wood can provide and for information on fuel types. Pollen analysis has been carried out on sites including Ballycroghan, Co. Down (DW01) (Smith 1955: 26–8). The latter study recorded a contemporary landscape that was very wooded and evidence was also recorded for plants that can be found growing in damp environments, such as sedge. Pollen indicators of agricultural activities, such *Plantago lanceolate* (ribwort plantain), *Rumex cf. acetosa* (sorrel), *Chenopodiaceae* (goosefoot family) and cereal-type pollen grains, were also present.

Recent palaeoecological investigations have shed further light on the landscape context of burnt mounds in relation to settlement activity. At Mooghaun, Co. Clare, these centred on a cluster of burnt mounds adjacent to a large lake. The vegetation record suggest a relatively open area with a scarcity of tall canopy trees near the lake. Cereal growing in the vicinity was indicated by the presence of wheat/barley pollen (Molloy 2005: 285). At Killescragh, Co. Galway (GY18) the analysis of two pollen sequences within close proximity of the burnt mound suggest the presence of a hazel pine dominated woodland that included trees of alder, birch, oak and elm. Wild grasses, sedges and other herbs formed the woodland understorey. This tree cover subsequently gave way to a wetter sedge-dominated environment. Environmental samples taken from a palaeochannel adjacent to a number of burnt stone deposits at Aghmacart, Co. Laois (LS09) contained small numbers of both land and freshwater snails. The analysis there suggest the sites were used in a damp, sheltered and probably well vegetated area, close to a substantial body of still or slowly flowing water (Lynch 2008). At Kilbegly, Co. Roscommon (RM12), an insight into local conditions is provided by moss samples taken from the trough lining. This revealed well developed woody vegetation that was presumably present nearby. The pollen data indicates hazel scrub rather than well-developed tall-canopy woodland, with oak, ash and yew present in low amounts. Bog taxa are poorly represented in the pollen record though the presence of *Sphagnum* presumably derive from the nearby mire (Overland and O'Connell 2010). At Curraheen 5, Co. Cork (CO37), the mosses appear to indicate a woodland floor or heath-land assemblage collected as bedding for underneath the timber trough, presumably to act as a filter. This assemblage also included a number of beetles and bugs, with most of the insect taxa consisting of aquatic species, including water beetles associated with fast flowing streams. Other beetles identified were woodland floor fauna. The co-existence of these suggests an accumulation of wood debris during intermittent flooding (Monk 2013). The site was probably located in marginal wetland with dispersed streams, flanked by drier, tree-covered ground.

An analysis of pollen from a bog in Ballytarsna, Co. Tipperary, was carried out as part of the M8 road scheme (Hopla and Geary 2008). This bog is adjacent to a number of excavated burnt mounds and revealed several phases of grasslands following forest clearance around the peatlands with woodland recovery. A pollen core taken from an Early Bronze Age burnt mound complex at Inchagrenoge, Co. Limerick (LK45), indicated that tree cover was quite low with only pine present in high proportions. The pollen record indicates the felling and/or burning of pine woodland prior to the construction of the burnt mound, and the use of the site or land nearby for both cereal cultivation and pastoral activity (O'Donnell 2007: 43). The area in the vicinity is interpreted as a grazed pasture or meadow, dominated by grass, herbs and seges (Brown *et al.* 2004). The charcoal and wood data from the site indicates a wetland landscape dominated by alder.

Figure 7.15. Burnt mound adjacent to stream at Frenchfort, near Oranmore, Co. Galway (RMP GA095-168). Source: William O'BrieN, UCC.

Figure 7.16. Burnt mound during excavation in low-lying area at Killarainy, near Moycullen, Co. Galway. Source: IAC Ltd.

At Leahys, Co. Limerick (LK51–52), the pollen diagram indicates a small gap or clearing in an alder woodland close to a water source, while the charcoal results show that the surrounding alder woodland was used as a source of fuel. Similarly, at Cragbrien, Co. Clare (CE29–30), the pre-mound environment was wet, alder-dominated woodland with pine and mixed oak/hazel, although the latter would considerably be reduced during the period of site use. The local area was interpreted as open, with scattered trees and herbs, and a pollen record dominated by pastoral indicators (O'Donnell 2007: 45). Analysis of Coleopteran from the trough indicated taxa indicative of water, waterside vegetation and possible woodland margin conditions, which correlates well with the charcoal results (Brown *et al.* 2004: 19). Pollen analysis at Cahiracon, Co. Clare (CE20–24), indicates a large clearing within a woodland comprised of oak, pine and alder on the margins of swampy land with slow moving water nearby. At Clowanstown 1, Co. Meath (MH82), it was apparent that a transition to a significantly more open local environment began to occur during the Early Neolithic. The woodland began to thin out and the herb communities indicates the presence of more grassy and pastoral areas (Geary 2008). The pollen record points to dense woodland in the vicinity. This is likely to have formed on the gentle slopes that surrounded the lake, with alder, willow and ash carr and scrub on the lake margins. Pollen analysis shows mixed deciduous woodland dominated by hazel (*ibid*.).

As observed in Chapter 4, wells or springs at burnt mounds can also contain important environmental evidence. Preserved plant remains have been recovered from a number of excavated well pits, including Kennastown 1, Meath (MH77), Williamstown or Bawn, Co. Meath (MH71), Johnstown, Co. Meath (MH74), Ballynakelly, Co. Dublin (DN25), Cuffsborough, Co. Laois (LS33), Coolfin 3, Co. Laois (LS28), and Lusk, Co. Dublin (DN22). Wild plant remains are often identified, such as buttercup, goosefoot, fat-hen, knotgrass, campions, sheep's sorrel, curly dock, dock, bramble, dead nettle, stinging nettle, elder and sedge. These wild taxa reflect an open scrub and hedge flora that commonly grows at the margins of woodlands and around settlement sites. Hazel nutshells and fruitstones of hawthorn, raspberry, blackthorn, sloes, elder and bramble are also particularly abundant giving some indication of the nearby scrub vegetation. Bronze Age wells have also been uncovered at a number of burnt mounds in Britain, such as at Reading Business Park, Perry Oaks, London and at Northwold Fen, East Anglia (Brossler *et al.* 2004; Lewis and Batt 2007; Crowson 2004). At the latter site, the environmental record indicated that people 'were exerting a tangible impact on the surrounding landscape; woodland was receding whilst grassland, and even limited cereal growing, were increasing' (Crowson 2004: 35). Grassland and woodland herbs and weeds were present alongside wetland plants. At Perry Oaks, London, the pollen and waterlogged plant remains from the well deposits indicated direct and indirect evidence of cereal growing as well as animal husbandry (Lewis and Batt 2006: 155), while at Reading Business Park there was a notable absence of trees and dominance of herbs and cereal pollen and associated weeds of cultivation are present (Brossler 2004: 112).

Charcoal analysis is an important component of any reconstruction of the natural environment of a burnt mound site. This must be done with caution, however, as sufficient sample numbers and fragments counts are required for a complete and full understanding of the immediate environment. The general woodland species exploited for fuel for pyrolithic activities were similar throughout the Bronze Age period. For individual sites, the presence of mixed assemblages of wood species in varying concentrations introduces variability into the sources of fuel used. The periodic dumping of charred remains associated with pyrolithic activity would inevitably result in the mixing of wood species from different sources from more than one burning event.

Variability in wood use is recorded from a number of sites excavated along the Bord Gais Pipeline to the West (Grogan *et al.* 2007). Analysis of charcoal from 44 burnt mounds dating from the Neolithic to the Late Bronze Age revealed that 19 taxa were present, with alder, ash, oak and hazel most commonly used as firewood (O'Donnell 2007: 32). Hazel was the most widespread tree identified on 95% of these sites. Ash was common in the Early Bronze Age, but subsequently decreased in frequency, as did oak in the Late Bronze Age (*ibid*.: 35–7). It is not surprising then that the associated 'pollen results suggest forest clearance in the areas of the burnt mounds immediately before and during their use', while the recovery of both dryland (hazel, ash and oak) and wetland (alder, birch and willow) species indicate that these burnt mounds were 'located in marginal areas on the boundaries of wetland and dryland environments' (*ibid*.: 38–9).

An examination of the charcoal assemblage from this study revealed similar trends. Some 19 taxa were identified, with alder, oak and hazel the dominant species. This is not surprising as oak and hazel make an excellent fuel and hazel is often found as an understory tree in broadleaf woodland dominated by oak. The latter usually grows on well-drained soils although it is tolerable of flooding. Alder normally thrives in wetland areas, suggesting the immediate environment may have been prone to flooding, which is often the case with burnt mound locations. Alder, ash and oak are the most frequent species used in the construction of plank-lined troughs, while hazel and ash were selected for wattle posts also used in the construction of wattle troughs. Results from hundreds of excavated burnt mounds throughout Ireland have shown that a wide variety of taxa are identified from these assemblages, which suggests firewood was selected from whatever trees and branches were closest to hand. Wood selection may also be an indication of the localised nature of these sites whereby small extended families were constructing the troughs using local trees and timbers. As highlighted by O'Donnell (*ibid*.: 37), the species preserved on these sites reflect the immediate surroundings and conditions.

At some sites the natural environment may not have been favourable for particular species, or deforestation may have occurred.

The combined environmental evidence from these sites suggests that while burnt mounds were located in damp environments, they were generally in close proximity to wooded areas on drier ground. The environmental evidence, therefore, supports Mitchell's suggestion, in his study of the burnt mounds and field systems on Valencia, Co. Kerry, that mounds were located in areas peripheral to managed farmland (1989: 19, 51–2; 66–8, 82–4).

The availability of a water source and suitable raw materials was probably the most important consideration in the choice of individual pyrolithic locations. Certain criteria are essential for the application of the technology. Water, stone and large amounts of wood fuel were the fundamental requirements for this water-boiling. Burnt mounds are usually situated in low-lying, poorly drained marginal land located close to a water source such as a river, stream, spring, pond, lake, turlough bog or marshy area (O'Kelly 1954; Ó Drisceoil, 1980; 1989, Waddell, 1998; Grogan, 2005; Ó Néill 2009). With a few exceptions, these sites were deliberately located in wetland, often at the interface with drier terrain (Figure 7.16). In some cases it can be demonstrated that these places would only have been accessible for specific activities on a seasonal basis. While the majority of sites are generally located in lower points in the landscape (0−60m OD), associated with poorer soils (Grogan *et al.* 2007: 88), some examples are also known on higher ground above 100m OD. Water is essential for pyrolithic activities, heated or steam vapour produced through the quenching of hot stones. Unsurprisingly, it has been shown that around 50% of the sites excavated along the N18 Oranmore to Gort road scheme are located within 500m of the nearest water resource (Delaney and Tierney 2011: 37). Although in some instances where a visible water source is not present, excavation has demonstrated that natural springs and wells are utilized, suggesting local knowledge of the natural environment (see Chapter 5). Excavation revealed previously unknown ancient paleochannels in the immediate vicinity of some sites such as at Kingstown, Co. Dublin (DN03), Coonagh West, Co. Limerick (LK61), and Aghmacart, Co. Laois (LS09).

Where sites have been identified in 'dry' locations, some have suggested a use associated with dry heat, as no obvious water source is evident in the vicinity (Dennehy 2008: 2). This is an important suggestion and is one that can now be confirmed archaeologically. Certainly, the smaller Type 3 and Type 4 sites were probably connected to dry heat, as their associated pits could not have been used as water receptacles (see Chapter 4). However, it is also important to note that modern agricultural practices may have altered the hydrology of many sites, and one cannot rule out the possibility of steaming pits that required small amounts of water. In most cases, however, burnt mounds were on or adjacent to low lying areas where troughs were dug into the water-table. Regardless of date or morphology, the availability of water must have been the primary motivation behind the relocation of sites for pyrolithic processes.

A number of other factors may account for the density of burnt mounds in particular areas. With a requirement for large quantities of stone, the location of these sites in fuel-rich localities was certainly important (Thoms 2009: 576). The availability of suitable stone may have been a limiting factor in site location. As outlined in Chapter 7, glacial drift geology is usually, but not exclusively used as a heating agent with sandstone deliberately selected in some cases and bought to the site over great distances (Danaher 2007; Cleary and Hawkes 2013). Suitably sized stones would have to be collected on a fairly regular basis, given the limited time a stone could be re-cycled once heated. The location of stone sources was probably familiar, returned to routinely, and part of a broader network requiring an intimate awareness of geological sources in the wider wetland landscape. While local river valleys were probably the source of much stone used in pyrolithic water-boiling, the use of stone cleared for agricultural (field clearance) purposes is also a possibility, showing a connection to local farming landscapes.

Social factors are also likely to be of significance, influences the location of burnt stones within a settlement territory and their proximity to residential centres. In most cases, it is likely that a combination of social, economic and environmental factors determined the siting of individual pyrolithic sites within a wider settlement landscape. The connection to place is also important and it is likely that the use of these sites was long-lived and may have had genealogical association linked to previous inhabitations. Returning to the same site and re-using troughs and constructing new ones may have helped to legitimate the user's rights to the land and certain resources giving the site an additional time depth. In contrast with the shorter-lived examples, some larger, more complex burnt mounds were used with the intention of extended occupation of that landscape. They could have been temporarily or seasonally abandoned, and re-used as required on certain occasions. With their well-defined physical presence in the landscape, particularly where sites cluster in small groups, this might have been about tenure of certain areas of good land, linked to particular owners/families who marked rights to land with the mounding of burnt stone from cooking episodes. The formation of mounds from this practice would have brought them into the realm of social memory by making it a place associated with feasting and myth of particular families or communities of those areas.

Clustering of burnt mounds in specific areas of the landscape likely also indicates sustained focus by individual communities over long periods within the wider landscape of social organisation. Bronze Age agricultural settlement was carefully planned to exploit the best available soils, which also took account of drainage and proximity to basic resources such as water and timber, not just for everyday living but for pyrolithic boiling also. The

seasonal use of some sites, for example those bordering turloughs, or in locations near seasonal bogs or rivers, might indicate different burnt mound locations continuing in use at different times of the year. These could even have formed part of a social 'round', whereby individual families hosted activities for the local community when their location was ideal for burnt mound activity (Grogan 2005: 74).

7.6 CONCLUSION

As already discussed, the spatial relationships between burnt mounds and associated house sites are complex due to the problems in trying to establish contemporaneity. Given the limitations of radiocarbon dating, the argument most often employed tends to be that two dates are not inconsistent, rather than confirming without doubt that both sites are contemporary. In Ireland, the distribution of burnt mounds is not equally spread out across the landscape, but concentrated within certain physical environments that were optimum for pyrolithic water-boiling and associated settlement. As the use of pyrolithic technology was a recurring activity in most areas, it can be suggested that working in and around burnt mounds was a common practice of many people's lives. In that sense, they may represent significant zones in which social processes took place within the contemporary landscape. The recovery of domestic material culture from many excavated burnt mounds confirms that they were an integral part of a wider settlement pattern. The identification of many burnt mounds within 1km of known Bronze Age settlement is also significant, and the abandonment or 'closing' ceremonies now apparent in both settlements and burnt mounds lends further support to this connection. The upsurge in use of pyrolithic technology during Bronze Age is also reflected in the progressive expansion of segmentary settlement during that period.

At another level, the burnt mound was probably an important symbol of group identity for local populations. The monument contributed to the history of their community in a particular location through its presence in a resource-rich locality. Emphasis should be placed on their role as an internal symbol of community for multi-family groups bound by close lineage relationships that promoted social cohesion through cooking and feasting. Instead of isolated hunting camps, we should expect these sites located within the environs of a contemporary settlement, with the occupants returning regularly. As a result it is possible to see the importance of the community in Bronze Age Ireland in the social dynamics of burnt mound use and their presence in the landscape. We must also recognise, however, that the present distribution of neither burnt mounds or associated settlements is not fully representative of the original site distribution. Equally, in identifying contemporary settlement zones across a landscape, we clearly cannot think of equal distance territories with arbitrary boundaries. Settlement patterns in different regions are heavily influenced by natural terrain and by the resource distribution that combined to create certain areas that were optimum for human settlement.

Not all burnt mounds share the same morphological features and social context, however their spatial patterning strongly suggests a segmentary tribal organisation. Different communities in Bronze Age Ireland adopted and adapted pyrolithic processes appropriate to their social organisation and customs. The latter included the adoption of common trough forms that were adopted in the make-up of these sites, thus explaining their widespread acceptance across all parts of Ireland, but their rejection by later communities with different values and social orders. The final chapter of this thesis will consider the broader evolution of pyrolithic technology in Ireland, from its inception on the Neolithic to its final demise sometime in the mid first millennium BC.

Chapter 8

Cultural context: the *longue durée* of the burnt mound phenomenon

This chapter will discuss the cultural context of the burnt mound phenomenon in prehistoric Ireland. This includes those developments that led to the origins of pyrolithic technology, from its initial use in the later fifth millennium BC to widespread adoption during the Chalcolithic and Bronze Age. The eventual decline of the practice during the early stages of the Iron Age will be considered, along with the mythologizing of this tradition in the early historic period. The aim is to understand how pyrolithic technology was practiced across different cultural contexts and the possible variability in use that may have occurred as a result.

8.1 INTRODUCTION

While the extent to which the technology was used at different times may be open to question, the frequency of these sites suggests that indirect heating using hot stones played a significant role in the lives of Bronze Age people. That said, burnt mounds can no longer be regarded as distinctively Bronze Age, as it now appears that the technology was used for approximately 3500 years in Ireland. This began during the Early Neolithic (*c.*3750 BC), with comparable sites appearing in England, Wales and Scandinavia from around 3000 BC. Such technology rose in popularity during the third millenium BC, reaching its maximum adoption during the Bronze Age. The number of dated sites drops off sharply in the early first millennium BC. Based on the incidence of well-dated examples, it is certain that burnt mound use did not retain the same significance over such a long period of time. Ireland does not seem to have been the most prolific centre of burnt mound use in prehistoric Europe. For the most part, the technology would appear to reflect a tradition of open-air cooking/feasting associated with communal/family-based food sharing, a practice that became particularly widespread during the Bronze Age.

The consumption of food is universal and is one of the most fundamental activities in any human society, helping to establish and sustain social and economic life. Activities related to food preparation are also indicative of the manner in which people use any landscape, including the interaction with the natural environment through agriculture and foraging. The practices whereby these activities materialise in archaeological contexts are widely diverse. In prehistoric Ireland, the cooking and consumption of food was carried out using both direct and indirect methods. Direct cooking involved roasting, boiling and baking in open fires, probably using ceramic vessels, spit structures or surface griddles, while indirect methods used a pyrolithic technology. The latter involved a process of heat transfer that centred on the use of hot stone immersed in water. Food consumption implies sociability, and so the use of pyrolithic technology in Ireland would have played an active force in the social construction of prehistoric societies, providing a symbolic representation of group identity expressed by a shared understanding of its use.

As O'Brien has observed, most general models of social and cultural change in prehistory are evolutionary in character, where human development and technology increase in complexity over time (1999: 264). Technological advancements are often seen as the driving force, spurred on by external influence whether through direct migrations, core-periphery relationships or peer polity interactions. In Ireland the use of pyrolithic technology first appears at the end of the fifth millennium BC, probably as an indigenous development related to cooking. Within a few centuries, external influences brought about the introduction of domesticated animals that possibly provided the impetus for new ways of cooking. The adoption of pottery, and in time metal, provides a pyro-technological background to the development of hot-stone processes. Over a thousand years there is evidence of large-scale use of the technology for other purposes over the entire island, possibly brought about by influences from a second wave of already established Atlantic contacts connected to the spread of metal use. The rapid spread of the new technology owed much to the steady increase in population, the settlement of previously unoccupied areas and the availability of raw materials, with the result that Ireland emerged as one of the most prolific users of burnt mounds in Bronze Age Europe.

Some features relating to burnt stone deposits represent continuity from the Early Neolithic. This is evident in the rectangular trough forms and the deliberate mounding of waste-firing material relating to continued and prolonged use of a particular site. The formation of burnt stone mounds entered the realm of social memory by associating these places with feasting and myth. These earlier events may have made such locations a suitable focal point for further activity in later periods (Jones 2013: 67). Continuity may also be inferred from the location of burnt mounds in marginal areas, highlighting the continued importance of water for their operation. Over time there were changes in relation to trough linings and site drainage, along with new features such as pits and associated structural evidence. This implies a continuous evolutionary model

with new and different pyrolithic practices emerging as a consequence of social evolution and economic development. It is likely that social memory at such sites was re-interpreted and used in quite different ways. It is necessary, however, to consider the origins and the first appearance of burnt mounds in Ireland, in order to gain some understanding of the circumstances that gave rise to its use.

8.2 Hot stones in Mesolithic Ireland

As outlined in Chapter 5, there was no burnt mound tradition in Mesolithic Ireland comparable to Bronze Age examples (Hawkes 2014). Where Mesolithic radiocarbon dates are recorded from burnt mounds, these can be shown to have no association with the use of a pyrolithic technology, and probably represent contaminated samples or earlier activity. This is supported by Bronze Age dates from more secure contexts in the same sites that are more likely representative of their true age.

The deposits of fire-cracked stone at Ferriter's Cove, Co. Kerry, Fanore More, Co. Clare and other Mesolithic midden sites cannot be explained simply as a result of accidental burning due to the volume of material encountered (Woodman 1999: 125). In the absence of any definite boiling receptacles, it is possible that the material did not accumulate from pyrolithic water-boiling, but from other indirect cooking methods such as roasting or steaming that only require small shallow pits (Figure 8.1). As discussed in Chapter 4 and Chapter 6, it is now evident that deposits of burnt stone are not produced by the same mechanism and for the same purpose.

It has been stated (McCormick *et al.* 1996: 83) that shellfish cannot be easily roasted using hot stones. While the boiling of shellfish may have been more efficient in this regard, there is ample ethnographic date from North America and other parts of the world that shellfish can be prepared in earth ovens and steaming pits (Wandsnider 1997; Waselkov 1987: 102). The application of such heating methods relaxes some gastropods and allows for the easy extraction of the mollusc using a thorn or other pointed implement (*ibid*.: 103). It is plausible that during the Mesolithic period this technology may have been used in the cooking of large amounts of marine resource (Figure 8.2). This may have been part of a broader emphasis on coastal resources, as large ungulates present in Britain (aurochs, elk, red and roe deer) were absent in Ireland at that time (Woodman and McCarthy 2003: 32). Hot stone technology may also have been used for cooking plant remains (Little 2010). A review of burnt stone excavated at a Late Mesolithic site on the shores of Lake Derravaragh, Co. Westmeath (Mitchell 1972) revealed macro-botanical remains, in addition to signatures of burning and heat fracturing from stone. In the absence of evidence for a boiling receptacle, or any mention by the excavator of in-situ burning, the deposits can only be viewed as spreads or dumps derived from a cooking-related activity (Little 2010). This activity is possibly associated with dry roasting or baking in shallow pits similar to the activities that may have been undertaken at other contemporary coastal sites.

Late Mesolithic occupation was concentrated along rivers and the sea, and it is obvious that fishing played a key role in the subsistence economy (Woodman 2004). However, issues relating to preservation may account for the lack of

Figure 8.1. Spalled and fire-cracked stone recovered from Ferriter's Cove, Co. Kerry (left) and burnt sandstone from shores of Lake Derravaragh, Co. Westmeath. Source: Woodman *et al.* 1999 and Little 2014.

Figure 8.2. Cooking shellfish using hot-stones in 'earth oven' method. Source: Richard Michael Gramly (American Association for Amateur Archaeology - www.asaa-persimmonpress.com).

recorded burnt stone deposits from this period, as much of the Late Mesolithic coastline has become submerged or eroded by rising sea levels over the past six thousand years. Recovery may also be a factor in other sites, with fire-cracked rock not given the same level of attention as artefact finds in the few excavations that have been undertaken for this period.

As outlined elsewhere, Mesolithic radiocarbon dates from burnt mounds can be shown to have no association with the use of pyrolithic technology, probably representing contaminated samples or earlier activity (Hawkes 2012; see Chapter 5). Mesolithic flaked stone tools have been recovered from 17 burnt mounds, however none of these are from secure contexts relating to the use of pyrolithic technology. While some form of hot stone technology may have been employed for dry roasting/baking during the fifth millennium BC, it is clear that the use of pyrolithic water-boiling technology did not become widespread in Ireland until the Neolithic. This is based on the identification of trough pits and domesticated faunal remains in excavated burnt mound/spread sites dating from the early fourth millennium BC (see below). This suggests that new cooking techniques emerged as a clear consequence of the adoption of animal husbandry and new attitudes to food consumption that were part of the farming lifestyle.

8.3 Burnt mounds in Neolithic Ireland

The adoption of farming in Ireland from around 3800 BC was characterised various elements of the 'Neolithic package', including carinated ware pottery, polished stone axeheads, domesticated plants and animals, permanent timber dwellings and megalithic tombs. As outlined in Chapter 5, a total of 50 radiocarbon dates and one sample dated by dendrochronology have been obtained from some 1000 excavated burnt stone deposits in Ireland. Out of 41 sites, five can be positively dated to 4000–3000 BC, with a further 24 dating to 3000–2500 BC. The radiocarbon samples from a further five sites have no association with the use of pyrolithic technology, being either intrusive elements to the site or representing activity pre-dating the formation of the burnt mound. Seven sites cannot be securely related to a pyrolithic boiling process as no troughs were encountered, though the site records in all cases indicate an activity associated with roasting or steaming. Diagnostic material culture has also been retrieved from some of these Neolithic burnt mounds in support of the radiocarbon evidence. Early Neolithic carinated ware from Clowanstown 1, Co. Meath, and Cherryville 7, Co. Kildare, place these sites firmly in the early fourth millennium BC.

The question remains as to why and where this pyrolithic water-boiling tradition originated in Ireland. The Neolithic is a period where populations became technically proficient in pyrotechnology. The use of hearths and fire installations were used for different purposes other than for cooking and warmth. Fire, along with water, fuel and stone tempers were used in the production of pottery, while similar resources were also needed for pyrolithic water-boiling. The recovery of large amounts of cereals and quern stones at the Neolithic site of Tullahedy, Co. Tipperary, confirms that food preparation was an important activity at this time (McClatchie 2011). Heat may have been used in the drying of such cereals for bread making and other processes.

Pyrotechnology moved to a new level during the Chalcolithic period when there was considerable expertise in the smelting of metal ores. While this period (*c*.2500–2000) would mark the beginnings of a more significant use of burnt mounds in Ireland, it is clear that the tradition was widely practiced prior to the adoption of metallurgy. Was this technology introduced from North Atlantic Europe as part of the 'Neolithic cultural package' or did it develop amongst native Mesolithic populations? The dating evidence suggests that most likely impetus came from the greater consumption by early farmers of meat in comparison to their Mesolithic processors.

Most commentators in the past have favoured external contacts for the transmission of new technologies to explain why certain practices were adopted, such as metal working. More convincing in relation to hot stone technology, is a combination of indigenous developments with external influences, where native populations adopted pyrolithic water boiling as part of the same cultural package associated with the introduction of the Neolithic. Some of the earliest burnt mounds were contemporary with the Neolithic house horizon, *c*.3750–3600 BC (Smyth 2010), and the first use of pottery and new types of stone tools (Sheridan 2010). Furthermore, diagnostic material culture dated to this period, such as carinated ware, flaked stone tools and polished stone axeheads has been found at a number of burnt mounds. This supports the radiocarbon evidence that places these sites firmly in the early fourth millennium BC.

It would be premature to rule out the possibility that some native peoples could have independently developed the technology once exposed to new ideas. There is a marked difference between Mesolithic and Neolithic use of hot stone technology in Ireland, based on the identification of trough pits and domesticated faunal remains from excavated sites dating from the first half of the fourth millennium BC. Furthermore, the discovery of domesticated animal remains in Neolithic burnt stone contexts suggests that new cooking techniques emerged as a clear consequence of the adoption of animal husbandry.

Although subject of continued debate, the cattle bone recovered from late Mesolithic contexts such as Ferriter's Cove, Kilgreany Cave, and possibly Sutton and Dalkey Island, may constitute the earliest dated evidence for domestic species in Ireland. Tresset (2003: 24) observes that 'one or more episodes of contact had occurred between southern and eastern Ireland and the western part of the Continent, where domesticates and husbandry appeared during the sixth millennium BC (in Spain, Portugal and

southern France) and in early fifth millennium BC (in north-western France)'. Woodman and McCarthy (2003: 36) suggest that young domesticated cattle may have been exchanged along the Atlantic coast to Brittany by 4000 BC, if not earlier. These same contacts may have brought domesticates into southern Ireland where large mammals were absent. Pyrolithic technology has also been recognised in the French Neolithic at sites such as Caliraux a Cubord, Charavines, Vinelz and Verdon (Strahm 1972-1973; Furger 1980; Ramseyer 1980; Pétrequin 1984; Pautreau and Funtugne 1996). These burnt mounds cannot be directly connected to water boiling as in the case with the Irish examples. The evidence from the rest of continental Europe provides few parallels for the type of sites found in Ireland and Britain (Ó Néill 2009: 24).

Ó Néill's analysis of forty-one radiocarbon dates from burnt mounds in Scotland suggests a possible beginning of the tradition there in the early to mid-fourth millennium BC (*ibid*.: 40). Only one site, Greenlaw in Dumfries and Galloway, is dated to this period, consisting of a single pit filled with heat-shattered stone (Kenny 2008: 67). A site at Kirkhill Farm in southern Scotland produced some of the oldest dated burnt stone deposits, with dates ranging from 3000‒2600 BC (Anthony 2003: 63). Anthony's study of burnt mounds in Orkney and Shetland provides dates ranging from the Late Neolithic through to the first century AD. A burnt mound at Kilmartin, also in Scotland is dated by thermoluminescence to 2800‒2400 BC (Anthony *et al*. 2001). Barber (1990) noted there is no record of burnt stones at Neolithic sites such as Skara Brae or the Links of Notland. He suggested that the first extensive use of heated stones for boiling in Scotland may only have developed in the Bronze Age. That said, there are Middle Neolithic dates from two burnt stone spreads at Parc Bryn Cegin, near Bangor in north Wales. Similarly, a series of isolated pits containing burnt stone dated 4220‒3790 BC at Cefn Du, Gaerwen, are interpreted as probable 'pot boilers' (Cutler 2012). The dating evidence from other Welsh, English and Scandinavian burnt mounds suggests that pyrolithic processes only began to be used during the early third millennium BC, contemporary with the widespread adoption of the technology in Ireland (Ó Néill 2009: 40; Topping 2011: 3).

British burnt mounds are the only pyrolithic sites in Europe to share the morphological characteristics of Irish examples, namely a trough, hearth and adjacent burnt mound. It has been noted elsewhere that the Scandinavian mounds of fire-cracked stone cannot be related to these examples due to the absence of troughs and the material found within the mounds themselves (Brindley *et al.* 1989‒90: 25). Current dating evidence from British burnt mounds suggests an origin in the Late Neolithic, which would mean the technology was used in Ireland at an earlier stage. A date of 2960‒2660 BC was obtained from a sample of charcoal (birch) from a burnt stone deposit excavated along the M6 at Crane Brook, immediately south-west of the Roman town of Wall (Trevarthen 2008: 83). It is difficult to access the significance of the Middle Neolithic dates at Greenlaw in Dumfries and Galloway (Kenny 2008: 67) and Parc Bryn Cegin, near Bangor in north Wales (Cutler 2012) as these represent the only possible Early Neolithic burnt mounds in Britain.

If cooking was the primary activity at these early pyrolithic water-boiling sites, the questions arises as to what role the latter played in the social structure of early farming communities and what differences, if any, are there with similar pyrolithic technologies in the Bronze Age? Although it is difficult to assess the significance of the earliest pyrolithic sites due to the small excavation sample, it is possible that the migration of farming groups into Ireland at this time, along with the introduction of domesticated cattle, created a new medium for exchange and new opportunities for feasting (Cummings and Harris 2011: 372). Cooney (2000: 43) observed that when these new resources were introduced to Ireland, so also was the knowledge on how to process these foodstuffs. This would have also created the potential for new ideas amongst native populations, who may have already been familiar with the use of pyrolithic technology (Woodman *et al.* 1999).

The animal bone from early pyrolithic sites such as Clowanstown 1, Co. Meath, Moorechurch, Co. Meath, and Cherryville 7, Co. Kildare, is dominated by cattle remains (Figure 8.3). This supports a cooking hypothesis associated with the beginnings of this technology in Ireland. Furthermore, the crushed calcined bone identified at Clowanstown 1, Co. Meath is thought to be consistent with butchery waste associated with the jointing of meat (Coles 2008). Mossop (2008) has tentatively suggested that marrow extraction may have taken place at the site. Certainly, the larger heat-effected stone would support short-term boiling episodes where marrow would become partly molten and easier to extract by melting through the foramen (Outram 2002: 58). This cooking process was possibly brought about by the introduction of new animal species, which would have created the potential for new ideas on wealth and status (Cummins and Harris 2011: 376). There is no denying that cattle in particular played a significant economic and dietary role in the Neolithic. Also important is how people conceptualised these animals, and how this impacted on practice (Cummins and Harris 2011: 367). Ethnographic accounts confirm that in many indigenous societies cattle symbolise wealth, power and prestige, and were only consumed during feasting rituals (Jiménez and Montón-Subías 2011: 143). Pollard (2006: 135) states that 'animals are woven into the fabric of social life through their ubiquitous presence and involvement in the creation and maintenance of social relations as a medium of exchange, feasting and offering'. Such occasions may have warranted communal gatherings for the slaughter, butchery and cooking of animals using pyrolithic technologies and the importance of such events is supported by the deliberate deposits found in burnt mounds at Clowanstown 1, Co. Meath, and Cherryville 7, Co Kildare.

Figure 8.3. Early Neolithic burnt mound at Clowanstown, Co. Meath. Source: Matt Mossop for ACS Ltd.

The use of pottery during the Neolithic was closely connected to cooking (Cleary 2011: 338), and its introduction was contemporary with the earliest dates for cereal growing in Ireland. Woodward and Hill (2002) suggest that the invention and adoption of pot-making reflects a more sedentary existence from the Neolithic onwards. Feasting now seems to be less frequent, taken outside the home base at some significant location, and following its own distinctive rules in relation to such matters as food choice (Jones 2002: 132). It is clear that pyrolithic water-boiling technology was not used to the same extent in early prehistoric Ireland as in later periods. This is supported by the large sample of 1000 or so excavated sites in Ireland, which surely would have accounted for a greater number if the technology was widely practiced during the Neolithic. The rarity of these sites during the Neolithic may suggest that the technology played a special-purpose role during this early farming period possibly associated with communal feasting. This might indicate that the consumption of cattle flesh during the Early Neolithic was not an everyday activity, but a special event observed at particular times and in particular places.

As observed in Chapter 6, prehistoric faunal assemblages do not provide clear indications of ceremonial feasting (McCormick 2009: 406). This is particularly true for the Irish Neolithic, as animal bone from this period is not common in the archaeological record. Possible feasting conducted as part of a burial ceremony has been identified at a number of excavated megalithic tombs (Manning 1985; Jones 2007: 108). Mount (1994) has argued that the animal bone assemblage discovered in front of the passage tomb at Newgrange, Co. Meath, is indicative of feasting practices.

Animal bone was recovered from nine pyrolithic sites dating to the Neolithic period *c.*4000–2500 BC. These assemblages are quite small consisting of fragmentary remains of cattle, deer and pig. A small amount of animal bone, consisting of cattle, deer and red deer, from Aghmacart, Co. Laois (LS09) was recovered from a palaeochannel adjacent to a number of spreads of heat-shattered stone. The presence of cranial and post-cranial elements of deer at the site may indicate the hunting and butchery of these animals (Tommasino 2008). No troughs were identified at Aghmacart, and so there is no evidence that boiling was the primary concern. Another small assemblage of animal bone was recently recovered from a burnt mound at Ballymount, Co. Kildare (KD25). Cattle and pig bones were retrieved from the burnt mound and the fill of a post-hole, and consisted of limb bones (humerus and radius). For pig, the only elements present are teeth which might be more indicative of poor preservation at the site than the activities that took place (Tourunen 2010). Animal bone remains of Neolithic date were also retrieved from Enniscoffey, Co. Westmeath (WM05), Gortaroe Area 1, Co. Mayo (MO27), and Blundelstown 2/3, Co. Meath (MH51), none of which can be identified to species.

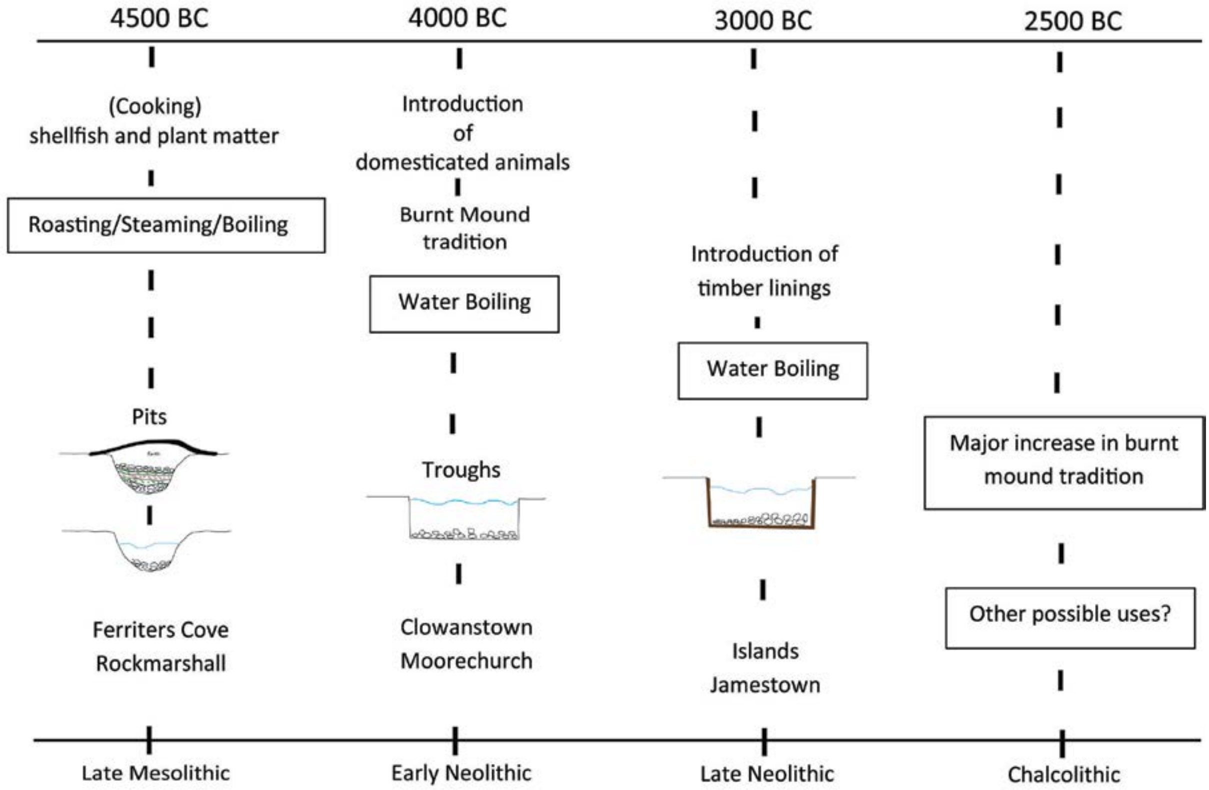

Figure 8.4. The development of pyrolithic technology in early prehistoric Ireland.

While finds of animal bone are increasingly common at excavated burnt mounds (Tourunen 2008), their significance is not always apparent. Their presence has led to several suggestions as to site function, relating to butchery practices and the possible preservation of meat at these sites (Roycroft 2006; Monk 2007). Preserving meat using salt may not have been an option in Neolithic Ireland, as this substance probably first became available during the Late Bronze Age (Serjeantson 2006). The smoking of meat in small huts may have been practiced, though no such structures have definitely been found associated with Neolithic pyrolithic sites. This suggests that large amounts of meat may have been consumed during a single event.

It has been suggested that the construction and occupation of rectangular timber buildings during the Early Neolithic must have created a sense of permanency within communities, even if these houses were not occupied on a year-round basis (Baily and Whittle 2005: 1). Although the question of seasonality cannot be firmly established at many of these early sites, a sequence of troughs at Clowanstown 1, Co. Meath, extending downslope from the mound may reflect seasonal activity related to nearby settlement activity. The large assemblage of cereal remains recovered from the mounds at Clowanstown confirms the presence of nearby farming communities. For instance, a recent study has indicated that soon after their introduction to Ireland (*c.*3750–3600 BC), cereals were being utilised in most areas within a remarkably short space of time (McClatchie *et al.* 2012). The large assemblage of material culture recovered from Clowanstown 1, Co. Meath (MH81) and Cherryville 7, Co. Kildare (KD07), indicates the presence of nearby settlement activity, even if these sites cannot be directly associated with contemporary Neolithic habitation. Only the site of Ballyglass West, Co. Mayo (MO41), produced evidence of possible settlement activity in the locality, with several phases of Neolithic identified at Lowpark, 1km west of the site (Gillespie and Kerrigan 2010). It appears that the earliest farmers in Ireland were not engaged in shifting cultivation, but rather created a sense of place and 'ownership' by investing in longer-term fixed-plot agriculture (McClatchie *et al.* 2012: 9). The presence of burnt stone deposits supports this suggestion if comparisons are made with their relationship with later Bronze Age settlement sites.

In conclusion, burnt stone deposits in Ireland were first dated to the Neolithic period by recent commercial excavation projects connected to infrastructural developments. Although the number of Neolithic burnt mound sites is small relative to the size of the excavation sample, it does highlight that pyrolithic technology was employed on a limited scale during the early farming period in Ireland. This review of recent dating evidence suggests that the early use of pyrolithic technology in Ireland may be divided into four stages (Figure 8.4):

• Later Mesolithic (*c.*4500–4000 BC). Early use of pyrolithic technology (roasting, steaming) for short-term cooking associated with Mesolithic forager groups.

• Early to Middle Neolithic (*c*.4000–3000 BC). Limited development of specialised 'burnt mound' areas for pyrolithic water-boiling associated with the butchering and cooking of domesticated animals. The technology at this time is possibly connected to communal or family-based ritualised feasting, possibly influenced by multiple strands of immigration from different parts of France into Ireland (Sheridan 2010: 89).

• Late Neolithic (*c*.3000–2500 BC). Generally increasing use of burnt mound/pyrolithic methods for cooking. Addition of timber linings within trough pits.

• Chalcolithic (*c*.2500–2000 BC). Intensified use of burnt mounds with advancements in trough construction, e.g. wattle lining and associated structures. Large scale use of pyrolithic water-boiling becomes widespread across Ireland, with other possible functions developing.

8.4 BURNT MOUNDS IN BRONZE AGE IRELAND

The radiocarbon evidence indicates that the most significant period of burnt mound use occured during the Bronze Age (*c*.2000–600 BC), when the deliberate mounding of waste-firing material from water-boiling processes was commonplace in designated parts of the landscape. Over this long period, these sites were an integral part of the settlement space of most habitations, providing social areas for gatherings of kin and neighbours to prepare and share food as part of a regular social round. Little attention has previously been paid to the social context in which these sites were used in the Bronze Age due to the absence of associated material culture and the low numbers of recorded settlement sites of the period. These questions can now be explored with the wealth of new excavation data provided by infrastructure archaeology.

As already discussed, the appearance of burnt mounds in fully Neolithic societies in Ireland must be partly explained in terms of external influences which brought about the introduction of domesticated animals. The widespread appearance of burnt mounds across the landscape with more advanced trough forms and other associated features during the Chalcolithic (*c*.2500–2100 BC) may be another consequence of external contacts. Similarly, the large number and wide distribution of new monuments, settlements and artefacts from this period suggests a general rise in population across Ireland, both within core Neolithic territories and also in new settlement locations (O'Brien 2012c). However, while external contacts should be emphasised, the more significant contribution may have come from the internal dynamics of indigenous societies.

Chalcolithic/Early Bronze Age

Archaeologists generally mark the end of the Neolithic by the adoption of metal use. In Ireland, this dates to around 2500–2400 BC, with important evidence of metal production coming from the copper mines at Ross Island, Co. Kerry (O'Brien 2004). The manufacture and use of copper objects in Ireland is associated with the appearance in the archaeological record of a distinctive form of ceramic vessel known as Beaker pottery (Carlin 2012). The introduction of Beaker pottery to Ireland *c*.2400 BC is highly significant as this material culture is associated with major social transformations across Western Europe at this time. This period is also marked by a new monument tradition, the wedge tomb, connected to changing funerary practices. Barrow (2012: 183) observes that the dating of burnt mounds to the Chalcolithic period in Wales presents an opportunity to broaden views of the period. The same can now be said for Ireland with the dating of some 120 sites to the period 2500–2100 BC. It is possible that the spread of pyrolithic technology and burnt mounds across the country during this time may have been a result of an expansion of exchange networks associated with the spread of Beaker pottery and related artefacts. As it is generally assumed that large-scale colonisation did not take place at this time, we must examine other mechanisms to understand how these developments in technology occurred. The increased use of pyrolithic technology relative to the Neolithic may certainly suggest an increase in population levels during the Chalcolithic.

The development of trough linings, particularly the carefully built plank examples must also be a direct consequence of metalworking tools for more delicate woodworking. The occurrence of beaker pottery at nine sites supports the interpretation that beaker-using societies were engaged in pyrolithic technology. Distinctive lithic assemblages of this period have also been recovered from sites such as Aghnahunshin, Co. Leitrim (LM10). The well-preserved beaker from Ballyclogh, Co. Wicklow (WW44) suggests that this vessel was deliberately deposited (Carlin 2012). This, along with possible votive deposits at Charlesland Co. Wicklow (WW22), Belan, Co. Kildare (KD32) and Coolroe, Co. Mayo (MO12), reveals a possible ceremonial element. This was first noted in the early Neolithic site at Clowanstown 1, Co. Meath (MH81), which may have been associated with long-term feasting practices.

The continued use of pyrolithic technology in the Chalcolithic might be seen as a re-affirmation of cultural values in a changing world. Bradley observed that people drew on the history and associations of particular forms of monuments and they changed them in accordance with their needs and the character of their own society (1993: 74). Cohen suggests how 'symbols of the past, attain particular effectiveness during periods of intensive social change when communities have to drop their heaviest cultural anchors in order to resist the currents of transformation' (1985: 102). This has been witnessed in the archaeological record, where some Late Neolithic sites were repeatedly returned to for water-boiling activities. It should also be acknowledged that some 're-use' may not have any relationship to previous activity, especially if the site was short-lived with no exceptional burnt stone deposits. It may, instead, represent opportunistic use of the same wetland location to access a water source.

That said, while wedge tombs may represent a continuation of a Neolithic belief system into the Bronze Age, the same could be hypothesised for pyrolithic water-boiling. Carlin and Brück (2012: 205) have illustrated evidence for continuity between the Late Neolithic and Early Bronze Age and suggest there is little evidence that the introduction of copper resulted in rapid or dramatic social change. While some features of the Irish Chalcolithic represent continuity from the late Neolithic, the degree of change across many areas of society does impart a distinctiveness to this period. While the Neolithic marks a considerable change in the application of the technology (i.e. water-boiling), advancements during the Early Chalcolithic are evident in the refinement of this technology, particularly with the addition of timber and wattle trough linings. As outlined in Chapter 5, these allowed for a more efficient method of water-boiling, maintaining the integrity of the pit in wet ground conditions and facilitating the regular emptying of heat-shattered stone from the trough. In addition, drainage features begin to be used during this period, highlighting new expertise in the management of ground conditions where site flooding was an issue. Formal hearths, which have not yet been identified at any Neolithic sites, indicate greater efficiency in the water-boiling process where hot stones were simply rolled into the trough. This ultimately decreased the amount of heat-loss emitted from the stone during transportation to the trough.

The majority of new Beaker settlement sites comprise scattered pits, stake-hole concentrations and occupation spreads (Carlin 2012). They have a low archaeological visibility, with no distinctive house types or domestic layout, and almost no evidence of enclosure. Some built structures are known, however these are few in comparison to the Bronze Age (Cleary 2007). House structures are known from this period, however their paucity in comparison to the Bronze Age is striking. It has been suggested that Beaker settlement in Ireland was marked by a significant degree of mobility. Certainly, the presence of butchered wild fauna in a number of Chalcolithic burnt stone deposits may support this suggestion. Red deer remains are generally scarce on later Bronze Age sites (McCarthy 2000), but have been recovered from 39 burnt mounds and are particularly common in Chalcolithic and Early Bronze Age contexts. For example, at Coolroe, Co. Mayo, red deer formed the major part of the assemblage accounting for 81% of the identifiable remains in an assemblage dated to 2571–2309 BC (Gillespie 2010). At Kilmessan, Co. Meath, the extreme base of an antler set was attached to one of the skull fragments indicating that red deer was hunted before the males lost their antler in late spring (McCarthy 2010). Alder charcoal from the burnt stone deposit is dated to the Early Bronze Age 2030–1880 BC. Similarly, at Balgeeth, Co. Meath, a red deer humerus showed a number of butchery marks representing the remains of a shoulder of venison that was cooked at the site (*ibid*.) (see Chapter 6).

Smaller sites composed of single pits and thin spreads of waste-firing material (Type 3 and 4; see Chapter 4) are also common at that time. By virtue of their size, these sites may reflect a significantly reduced duration of pyrolithic activity for small-scale episodic cooking (water-boiling and dry roasting/steaming) (Figure 8.6). Examples include those at Moneycross Upper, Co. Wexford (WX17) dating to 2460–2150 BC, Kilduff, Co. Cavan (CN11), dated to 2458–2151 BC, and Ballyquirk, Co. Kilkenny dating to 2292–2143 BC (Figure 8.5). Other smaller pyrolithic sites dating to this period would be those identified at Cloonturk, Co. Leitrim (LM05); Fauleens, Co. Mayo (MO60); Aghmacart, Co. Laois (LS10); Cahiracalla More, Co. Clare (CE43); Blackrath, Co. Kildare (KD24); Ballinter, Co. Meath (MH31b), and Ballylean Co. Clare (CE15). As outlined in Chapters 4 and 6, these smaller sites have not been widely discussed as separate, distinct entities in Ireland and Britain with many simply being categorised under the heading 'burnt mound' or 'pot-boiler'. The shallow pits that often accompany these deposits could not have been used as water receptacles and are more likely suited to baking/roasting or steaming. For instance, it has been demonstrated in other parts of Europe and North America that pits of this nature were used as ovens (Hurl 1990; Wright 2000; Campling 1991). Others, however, are deep enough to have functioned as water-boiling pits.

Figure 8.5. Type 3 and Type 4 sites at Moneycross Upper, Co. Wexford (top) and Caheraphuca, Co. Clare (bottom). Source: VJK Ltd and IAC Ltd.

These Chalcolithic and Early Bronze Age burnt mounds, together with the presence of wild fauna in a number of examples may indicate that technology was used by more mobile elements in society. The extensive mound deposits

at other sites, along with well-defined timber troughs, suggests that most were probably associated with more permanent settlement where small family groups carried out water-boiling activities. This is also supported by the presence of domesticated faunal remains in many examples, such as Mullamast, Co. Kildare (KD21), Coonagh, West, Co. Limerick (LK61), and Marlinstown, Co. Westmeath (WM18). Permanent farmsteads and field patterns dating to this period have been recorded in other parts of Ireland (Jones 1998). Pollen evidence also indicates a possible intensification of farming in many parts of Ireland at this time, based on a continuation of older Neolithic farming patterns (cattle/pig pastoralism; wheat/barley cultivation).

This evidence contrasts with the picture of contemporary settlement in Britain, where enclosed settlements and field systems only emerge after *c*.1500 BC, with the early Bronze Age settlement evidence suggesting a considerable degree of residential mobility (Barrett 1994; Brück 1999). It has been observed that 'the relationships between people and places were defined not through permanent attachment to a single locale but through traditions of movement around the landscape. These practices were fundamentally different to those of the modern Western world in that they did not involve the construction of substantial, permanent 'houses', or a definition of 'dwelling' that identified or prioritized domestic activities' (Brück 2001: 70). That is not to say that a certain level of movement between different locales did not happen in Ireland during this period, but that a significant degree of sedentary living is illustrated by the archaeological evidence. Permanent habitation sites with broadly contemporary burnt mounds in the immediate vicinity include those at Cloghers, Co. Kerry (KY06), Graigueshoneen, Co. Waterford (WD04, WD07 and WD08), Raheenagurreen West, Co. Wexford (WX21), Jordanstown, Co. Kilkenny (KK54), Carrigatogher Harding, Co. Tipperary (TY50−53) and Cherrywood, Co. Dublin (DN05) (see Chapter 7).

Middle/Late Bronze Age

At the end of the Early Bronze Age, a transition took place in the nature of society across much of Ireland. In the archaeological record, this is documented by a significant change in burial customs, with the older traditions of wedge tombs, food vessel burial and in-urned cremation giving way *c*.1500 BC, to new cremation practices. There were also regional developments; for example, in the south-west of Ireland where stone rows, stone circles and boulder burials emerged. Of particular importance, however, is the appearance of substantial enclosed settlements and field systems (Cleary 2007; Ginn 2012). During this period, settlements consisted of several post-built roundhouses (usually between one and five) accompanied by other structures or features. These sites were frequently surrounded by banks, ditches or palisades,

Figure 8.6. Early Bronze Age burnt stone spread at Cloonfane II, Co. Mayo. Source: Dominic Delaney.

and some appear to have possessed substantial gated entrances (Cleary 2007). It is generally accepted that each such settlement was occupied by a single household group. The pattern is one of dispersed independent farmsteads located short distances away from their known neighbours (Ginn 2012: 30).

The concentration of burnt mound sites during this period corresponds with a general trend in settlement expansion for which dating evidence is available. Some 196 burnt mound deposits have returned 248 radiocarbon dates dating to the Middle Bronze Age *c*.1600–1200 BC. There was a significant change in relation to trough form, with the first use of hollowed-out logs and re-used dug-out canoes for water-boiling. While the use of plank-lined troughs continues, wattle-lined examples are seemingly abandoned. Roundwood begins to be used in trough construction and the first use of stone for linings appears during the later part of the Middle Bronze Age, *c*.1300–1100 BC (Figure 8.7). Other stone components such as paving slabs and cobbled surfaces emerge in the record, while stone-built hearths also begin to be used with with boiling pits. Associated features such as wells, windbreaks, stave-built racks, mound revetments, drainage pits and structures are also commonly found at burnt mounds of this period.

Figure 8.7. Rectangular roundwood-lined trough at Ballyglass, Co. Sligo. Source: Dominic Delaney.

As previously discussed, a small number of sites dating to this period have produced roofed structures with internal troughs. While the primary purpose of these structures may not have been the production of steam, the substantial nature of the troughs, stone-built hearths and the expertise involved in water management suggests a specialised role within Middle to Late Bronze Age societies (O'Brien 2009; 2012; Hayden 1994; Fay 1960). The collection of fresh water, for the purpose of boiling within lined troughs using heated stones, is highly significant when considering the purpose of these variants of the burnt mound phenomenon (Type 6 sites; Chapter 4).

By the Middle Bronze Age functionally and spatially distinct domestic settlement sites had become a feature of the settled landscape and the widespread use of pyrolithic technology indicates these sites were an integral part of the settlement pattern. The location of many burnt mounds within the settlement environs of many structures, some even immediately adjacent to habitations (see Chapter 7) might seem to weaken the interpretation of some burnt mounds as communal feasting places. While it is probably the case that many served as small familial cooking sites associated with contemporary settlement, the provision of communal feast by different landholding units at different times, may have offered members of the wider community the opportunity to consume meat on a more frequent basis than individual families were capable of (see Chapter 6). This may explain the deliberate planning and careful construction of Type 7 structures with stone-built hearths and large lined troughs having substantial structural coverings. Such sites may have provided arenas for communal feasts, where the size of the water-boiling trough was capable of cooking large amounts of food during a single event.

As outlined in Chapter 7, the 'domestic,' communal, and 'ceremonial' uses of the technology were not mutually exclusive. The apparent desire to enhance a basic site form, together with the careful, perhaps formal organisation of space around central troughs, might imply that many sites were not simply used as domestic space by a single family, but were perhaps open to members of the wider community to maintain social cohesion. These social gatherings may have been connected with events linked to intense personal and collective experiences: on special occasions such as births, weddings, deaths, rites of passage, religious festivities relating to seasonal changes and agriculture. This is also relevant for the development in the later Bronze Age of possible sweatlodges and the use of the technology for the creation of steam. Ethnographic sources suggest that the use of the technology in this manner was of considerable social and spiritual significance to the communities who built them (Eogan 2007; Eogan and Shee Twohig 2011). Perhaps the most significant aspect of the familiar however, is suggested by the evidence of 'commemoration' at burnt mounds (see Chapter 7). This evidence compares to contemporary habitation sites where objects are placed as foundation or closing deposits.

The Late Bronze Age was a period of fundamental social change in Ireland, with population growth and expanding settlement in most areas. While this was still a highly fragmented society made up of many small communities, there is some evidence to suggest that some territories may have been controlled along with economic production and exchange networks at a higher level (O'Brien 2012b: 204). This period is much different for the earlier part of the Bronze Age in that the existence of elites is largely inferred from the metalwork evidence based on the circulation of valuable objects made of gold and bronze, which were the possessions of strong regional societies. The large-scale production of swords and other bronze weaponry, as well as the building of hillforts in strategic positions in the landscape suggests that this was also a period of social instability and endemic warfare. A total of 161 burnt stone deposits are radiocarbon dated to the Late Bronze Age period, *c.*1200–800 BC, with a further 42 sites dating to Late Bronze Age/ Iron Age transition phase, *c.*800–400 BC. Both communal and family based cooking is inferred from the evidence and in a small number of cases, artefactual material suggests an affluent society. This is based not only on the recovery of gold and bronze artefacts from a number of burnt mounds of the period (some of which were deliberately deposited) but also finds from other Late Bronze Age contexts in Ireland (Waddell 2000).

8.5 Iron Age Ireland: The end of pyrolithic water-boiling?

Although early commentators were of the opinion that burnt mounds dated from 'about 2000 BC and the end of the 16th century AD' (O'Kelly 1954: 144), this study has confirmed that the process of pyrolithic water-boiling was essentially a Neolithic to Bronze Age phenomenon. It is also likely that the use of hot stones for other cooking processes had earlier origins (Hawkes 2014). As outlined in Chapter 6, in the absence of other forms of evidence we are reliant on radiocarbon dating to identify Iron Age and medieval burnt mound traditions. Many of the sites assigned to these periods have been identified on the basis of single radiocarbon determinations. In the absence of further evidence, radiocarbon or artefactual, it is possible that the dated material was either residual or intrusive in these contexts (Hawkes 2012).

In contrast to the preceding Bronze Age, the evidence for Iron Age pyrolithic activity is very limited. A critical review of the radiocarbon evidence suggest that burnt mounds ceased to be used in Ireland during the latter stages of the Early Iron Age, sometime around 400 BC. During the Middle Iron Age, there is tentative evidence of an enduring burnt mound tradition in some areas, but one that was not as widespread and certainly, not as popular. Sites at Moone, Co. Kildare (KD33), Fermoy Wood, Co. Cork (CO58), and Rath, Co. Meath (MH25) provide evidence that a pyrolithic technology was employed on a much lesser scale *c.*300–100 BC (Figure 8.8). At the latter site, the sample was retrieved from a structure interpreted as a sweatlodge. There is no evidence to suggest that the technology continued to any great extent after this period, with many of the Late Iron Age dates now considered to be problematic in terms of their sample origin (see Chapter 5). There are a small number of exceptions, however, with the unpublished site of Barnahely, Co. Cork (CO62) dating to the Middle to Late Iron Age, providing some evidence to indicate that the abandonment of the technology was not a single event that occurred across Ireland. Nonetheless, as with most parts of Britain, there seems to be an almost complete hiatus of burnt mound activity by the last quarter of the first millennium BC with only parts of Scandinavia having a continued but considerably reduced use of the technology into the period in the middle of the first quarter of the first millennium AD (Ó Néill 2009: 41).

One of the most interesting results of the analysis is that a significant number of these later burnt stone deposits fall within the earlier part of the Iron Age (*c.*800–400 BC). This compares well with the recent preliminary results of 'The Iron Age Ireland Project' which has looked at new evidence from infrastructural projects (Becker *et al.* 2008; Becker *et al.* 2009; Dowling and McCarthy 2011). Traditionally, the transition to the Iron Age has been poorly understood with the centuries between 700 and 400 BC regarded as a 'Dark Age' due to the scarcity of archaeological material dating from this period (Raftery 1994). This had been proposed as evidence for a cultural impoverishment that went hand in hand with the demise of bronze working. However, the new evidence suggests some degree of continuity between both periods in terms of the settlement record (Becker 2009: 358). For instance, plank-lined troughs of the Early Iron Age in Ireland indeed show degree of continuity with the Late Bronze Age with many of these dates reflecting re-occupation of early burnt mound sites (Chapter 5). House forms of the Early Iron Age also show some similarities. However, other aspects of the archaeological record reminds us that there may not have been an overall cultural continuity, with the disappearance of stone ritual monuments and late Bronze Age metalworking traditions and increasing evidence for iron-working.

With the emergence of 'royal sites' and the adoption of continental La Téne style metalwork in Ireland in the late first millennium BC, coinciding with the re-emergence of formalised burial, there are grounds for assuming significant social and cultural changes (Becker 2009: 358). From 300 BC onwards there was a transmission of many elements of Celtic culture to Ireland, which has sometimes been explained by a military invasion or some other large scale population movement from the La Téne culture zone. However, it is now preferred to see these as prestige objects of a small, but politically significant elite (Raftery 1994; O'Brien 2009). While the situation might be changing as a result of developer-funded archaeology, the latter period of the Iron Age is still marked by a distinct lull in the archaeological record. This period has been associated with a decline in evidence for farming in many parts of Ireland (Mitchell 1976; Plunkett 2009), however

the duration and intensity of this decline is now known to have varied across Ireland.

In an assessment of the Mount Hekla volcano and the dendrochronological evidence, Baillie (1990: 167) made the suggestion that the use of burnt mounds was affected by the eruption of Hekla in 1159 BC, with the catastrophe initiating a significant reduction in their use in the first millennium BC. This event prompted suggestions in the late 1980s that this rapid environmental downturn as a result may have led to social upheaval at the start of the Late Bronze Age (Mallory and Warner 1988; Baille 1990; Baillie 1993). As Plunkett has suggested, 'it may be significant that in several Irish bogs, continuous peat humification records across this period suggest a possible widespread increase in surface wetness sometime *c.*1150–1050 cal. BC' (2006: 64). It is hypothesised that this environmental downturn is linked to the abandonment of low-lying areas and the concentration of populations in large political centres such as hillforts. As the use of burnt mounds is associated with subsistence economies of the Bronze Age, a disruption of this settlement economy would be the most plausible catalyst for demographic and socio-political upheaval.

An analysis of the pollen record of this period, however, demonstrates that relationship between Hekla 3 and the 1159 BC tree ring anomaly can now be dismissed, and the eruption, which occurred in the 11th century BC, seems to have had little impact on the environment (Plunkett 2006: 66). Pollen evidence across this period shows no indication that this event disturbed the subsistence economy to any extent. This is supported by the dating of many burnt mounds and settlement sites to this period. The Bronze Age–Iron Age transition (700–300 BC), clearly coincides with greater pressure on food resources, although a small number of studies hint at a contraction of settlement in some areas (Plunkett 2009). The pollen records from this period also reveal reduced impact on the landscape from farming activity, accompanied by woodland regeneration (Lynch 1981) and a considerable decline in the use of burnt mounds. Plunkett observed that a collapse in the agricultural economy as a result of soil exhaustion is unlikely to explain this cultural break, preferring instead the spread of Hallstatt D culture in central Europe as a more compelling argument in favour of economic upheaval caused by the severance of external trade links (2009: 293). For Plunkett, the general declines in other aspects of the archaeological record, such as

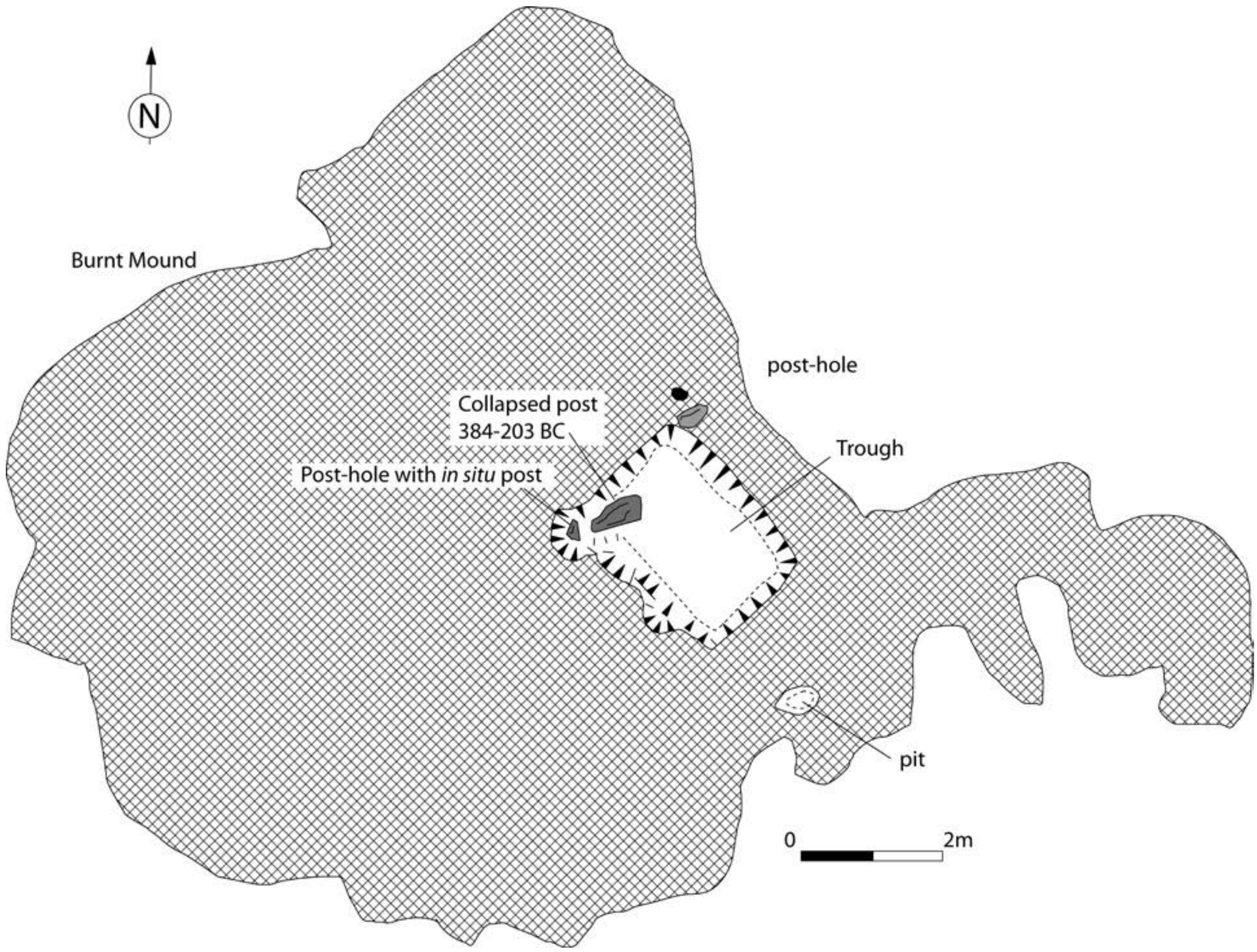

Figure 8.8. Plan of excavated features at Fermoy Wood, Co. Cork. Source: Redrawn from Sutton 2006 - Eachtra Archaeological Projects.

wetland activity and burnt mounds, may correspond to a centralisation of settlement and subsistence production in some areas, with the impetus for these changes caused by socio-political developments, and possibly connected to wider economic upheavals beyond Ireland (*ibid*.: 293).

The connection between the end of the burnt mound tradition and the first use of cauldrons should also be considered. The dating of these sheet bronze vessels coincides with the sudden decline in the use of pyrolithic water-boiling around the 8th century BC. This may signify that ceremonial feasting became a more exclusive activity that was confined to pre-eminent individuals in that society (O'Brien 2012b: 214). There are obvious elements of both continuity and change in the two forms of cooking. Continuity may be seen in the volume of water heated as indicated by the relative size of certain cauldrons and many burnt mound troughs. This implies that group feasting remained important at this time. Heat altered stone, however, has not been found associated with any bronze or iron vessels. While Jockenhovel (1974: 334) suggests that they were set in the ground and used like an Irish prehistoric cooking places, citing the fact that so many vessels have repaired or replaced bottoms as evidence they were used for direct methods of cooking, possibly placed over a fire (Gerloff 1986). The suggestion is that cauldrons were primarily ceremonial cooking vessels and their association with fleshhooks suggests that they were used for cooking meat or keeping it warm.

The end of this tradition should not be conceived solely in terms of the cessation of pyrolithic technology, but rather in the changing pattern of open-air family-based cooking and the introduction of a dairying economy. Burnt mound locations may have represented a shared ideology that brought household groups together as part of a symbolic construction of community. This situation would have changed significantly during the Iron Age into the early medieval period with the expansion of arable agriculture, mobile pastoralism and dairying. The Irish Bronze Age is generally viewed as a period of extraordinary material wealth probably based on a strong archaeological economy. The end of the burnt mound tradition is marked by the appearance of elite feasting practices using bronze and iron cauldrons, which ultimately suggests a significant ideological break with the past and the significant use of pyrolithic technology. As Bradley observes 'people did not make artefacts or build structures according to a traditional format because they were unable to think of anything else. Rather, they did so as one way of adhering to tradition and maintaining links with what they knew of their past. In the same way, choosing to break with traditional practice may also have involved an explicit position on the relationship between the present and the past' (2002: 11).

These open-air methods of water-boiling may have been replaced because the core belief these processes enshrined were no longer relevant to societies developing needs. The gradual emergence of an increased concentration of power under strong authority figures may have confined the consumption of cattle flesh to particular individuals or groups in that society. The regeneration of woodland in a number of areas during the later Iron Age indicates a reduction in open grassland, with a consequent impact on animal pastoralism (O'Brien 2009: 341). By the early medieval period these sites had ceased to be used to be used for a millenium or so and were now part of a mythologised landscape (Hawkes 2012; see below). The early medieval period in Ireland coincided with a major re-organization of Irish society, with fragmentation of political power and a greater dispersal of settlement (Edwards 2005). The development of dairying may have been a significant factor in the emergence of a subsequent ringfort-based farming (McCormick 1995: 36). Prehistoric burnt mounds probably evoked a variety of emotions in these later social landscapes, from curiosity and respect, to opportunistic use providing dry areas for other activities, unrelated to pyrolithic technology (see below). As Bradley has observed 'like archaeologists today, people in the past would have been forced to engage in acts of interpretation, and that very process can tell us something on their shifting preconceptions' (1993: 91).

8.6 BURNT MOUNDS IN LATER PERIODS

The archaeological evidence suggests that considerable caution should also be applied to medieval radiocarbon dates from burnt mound contexts in Ireland (see Chapter 6). This is demonstrated at a number of sites that have returned modern dates, for example Derrygarrif, Co. Clare (CE57), and Richmond, Co. Tipperary (TY23). Such instances draw attention to the sampling strategies employed at some sites and highlight the necessity to carefully select samples for dating (see Chapter 5). A number of sites have produced both prehistoric and medieval dates showing clear origins in the Bronze Age with a re-use of these locations in later periods. This emphasises the importance of multi-context sampling to understand the overall chronology of a burnt mound with a long history of use. The sites of Crabbsland, Co. Limerick (LK19), Ballyman, Co. Dublin (DN01), and Tullahedy, Co. Tipperary (TY27) are examples, suggesting a later use of a burnt mound location for activities associated with iron working. As outlined in Chapter 6, other spread deposits that are dated to the medieval period are too insubstantial to be interpreted as burnt mounds and could represent single-episode events such as small fire-spots relating to tree and scrub clearance where stones were burnt as a result.

The clearing of scrubland and forest cover for agricultural purposes was a common practice in early medieval Ireland. The burning of unwanted vegetation decreases soil acidity and enhances soil fertility (Rambo 1980: 311). Fire was also used in order to remove large boulders and rocks during field clearance. This process, known as fire-setting, was still carried out in Ireland until the early twentieth century. A deposit of heat-shattered stone excavated at Trusk Road, Ballybofey, Co. Donegal, was found in and around a large stone (Buggie and Tierney 2006: 12). A fire relating to scrub clearance may also be identified at Cloonfane IV

(O'Carroll 2007: 7). The same is likely for sites such as Ballymackeamore, Co. Limerick (LK34), and Balreask 3, Co. Meath (MH33c), although small fragments of animal bone in these deposits may indicate cooking fires.

Similar spreads of heat-shattered stone with no associated pits are frequently found in a prehistoric context. The prehistoric examples, however, are much larger and usually uncovered on pipeline and sewerage schemes, where the full extent of the site cannot be revealed. Those spreads of medieval date uncovered on similar schemes were mostly isolated deposits confined to the limits of the development corridor. In the absence of cut features such as troughs and pits, others have suggested that portable boiling troughs may have been used, consisting of wood, ceramic, bronze or leather (Ó Néill 2005; Danaher 2007: 16; Figure 8.9). Some historic sources describe using heated stones to cook in a water-filled bag (French 1899: 43), however experimental work using this technique recorded mixed results (Ryder 1966; 1969). Such activities would leave small, discrete deposits of heat-shattered stone, with no evidence of the container used to hold the liquid being heated. Historic references to such cooking practices probably relate to boiling events using direct heat from the fire rather than hot-stone boiling carried out in lined, sunken pits. Ó Néill (2005: 83) acknowledged that it is problematic to identify material evidence in the archaeological record that is analogous to descriptions in the historical sources. He also states it is necessary to dismiss evidence with clear indications of different processes (*ibid.*: 82), a view supported by this review of the medieval dates from Irish burnt mounds.

People have engaged with wetland environments in Ireland since earliest times. It is, therefore, not surprising that locations with burnt mounds were occupied during the medieval period, when these features were exposed as visible entities in the landscape. The opportunistic use of these locations during the medieval period can be demonstrated at a number of sites, most notably at a site at Cashelduff I, excavated on the N25 Charlestown Bypass, Co. Mayo. Here, two raised dry areas in marshy ground were used for charcoal production during the medieval period (Gillespie and Kerrigan 2010: 37). The raised area was the site of a disturbed cairn or megalithic tomb of possible Neolithic date, which was reused for charcoal production in AD 1055–1270 (*ibid.*: 44). A charcoal production pit and a medieval kiln were revealed on a slight terrace adjacent to a Neolithic burnt mound at Ballyglass, Co. Mayo (MO40). The pits identified at Ballymackeamore, Co. Limerick (LK33), Cloongownagh 2, Co. Roscommon (RM04), Hallsfarm I and 2, Co. Westmeath (WM56 and WM57), Shanboe 5, Co. Laois (LS44) and Sonnagh VIII, Co. Mayo (MO55), may be related to the production of charcoal in the medieval period, for which there is growing evidence in Ireland (see Kenny 2010: 109).

A pre-requisite for the production of charcoal is wood, therefore production pits need to be situated in areas where ample resources are available. Large quantities of wood

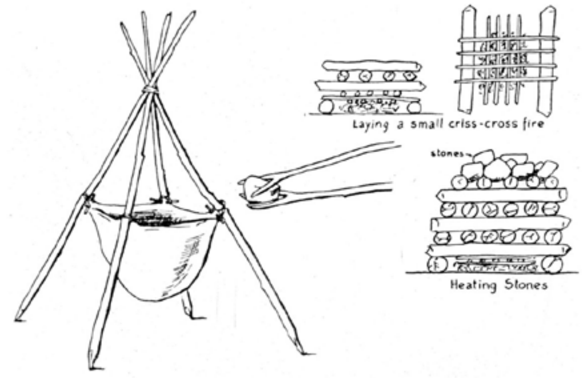

Figure 8.9. Hot stones used by Native American Indians to boil soup in a buffalo stomach pouch. Source: Reginald and Gladys Laubin: 1957.

are also fundamental for hot stone processes, which may explain the similar location of the two site types. Such processes would have been located some distance from the main settlement as they posed a serious fire risk to any timber structures and created large amounts of smoke (Kelly 2000: 369). Burnt mounds would have provided suitably dry locations in otherwise wet environments for charcoal production and other 'industrial' activities in the medieval period. Comparisons have been made between burnt mounds and iron working sites in so far as both represent small scale episodic activity conducted over time by a nearby community (Carlin 2008: 107).

The utilisation of burnt mounds during the medieval period may be paralleled in Britain. A site at Kilearnan Hill, north of Scotland produced a number of Bronze Age dates, however a date of AD 1300–1490 was obtained from burning at the top of the mound (Anthony 2003: 91). This later activity does not seem to have been related to pyrolithic processes. A radiocarbon date of AD 680–980 retrieved from a burnt mound at Kirkhill farm in Dumfries and Galloway must be considered unreliable as it is the only one such medieval date from a site that has produced several prehistoric dates (Ó Néill 2009: 241). Partial excavation of a mound of burnt stone in Morfa Mawr, south-west Wales produced an Early Medieval radiocarbon date (Williams 1990: 134). No water trough or hearth was identified at this site so it cannot be considered a burnt mound (Brindley *et al.* 1989–1990: 30). The site of Auld Taggart 4, East Rhine, is the only burnt mound site in Britain to produce reasonably conclusive evidence of a medieval practice of water-boiling similar to prehistoric site-types (Russell-White 1990: 75). The site consisted of a low mound of burnt stone that overlay an unlined pit. Three medieval dates were obtained from a possible hearth area and from the body of the mound material (*ibid.:* 75). An adjacent burnt mound (Auld Taggart 2) is also dated to the Early Medieval period (*ibid.*: 74).

While burnt mounds were often visited in later periods of prehistory, the activities undertaken at these locations

during the medieval periods were unquestionably different. Although their original significance may have been lost, an awareness of hot-stone technology may have been acquired through later encounters with these sites or an empirical understanding of their use may have been gained through folk memory. Being the most numerous prehistoric site in the Irish landscape, burnt mounds would have been highly visible, either as individual sites or in close clusters. This would have been even more evident before the advent of intensive agricultural practices in the modern era that resulted in the levelling of many sites. As Bradley has observed, monuments by their very presence can dominate the landscape of later generations and provide constant reminders of the past (1993: 19). As already mentioned, we cannot discount the possibilities that some burnt mounds were dug into during the Medieval period to reveal timber troughs and other related features. Such sites would have created a sense of mystery and speculation during later periods of history, promoted by earlier oral accounts, creating an opportunity to express tales about past societies through folklore and storytelling. Tales like these may have inspired investigations leading to an understanding of the processes involved. This may account for certain references where an appreciation of the sites antiquity is evident. For instance, the twelfth-century text, *Agallamh Beg* refers to an '*inadh fulachta*' (cooking place) that had 'long since been made' (Ó Drisceóil 1988: 673). As these places were used over a long period of time, memories of their original design and use might have become unstable, as so often happens with oral traditions. While they draw on literary sources, that has more to do with the popularising origin myths than it does with modern notion of history.

Whether related to cooking on a spit or in a boiling trough, we can be confident that the term '*fulacht*' and its derivatives refer to a cooking activity in some capacity. The term might have been adopted by later writers who recognised an ancient form of cooking from their understanding of the visible remains. Therefore, the pseudo-historical material that sought to associate *fulachtaí fia*/burnt mounds with *Fionn MaCumhai*l and his band of warriors can be regarded as little more than a deliberate archaism fostered in medieval times to present an image of a lasting tradition. This is attested to by the literal translation of '*Fiadh*', a nineteenth-century invention, meaning 'of the deer' or of the wild and similarly, '*Fian*', meaning of a roving band of hunters or warriors' or 'of the *Fianna*' or *Fionn Mac Cumhail* (Ó Drisceoil 1988: 673). The archaeological evidence suggests instead that these sites were not isolated places in the landscape, but rather part of extended areas of Bronze Age settlement. The increasing level of domesticated animal bone, specifically cattle, found during recent excavations would certainly contradict the hunting camp theory.

While reference to similar processes in early Irish literature has promoted a folk memory of a burnt mound tradition into the Early Medieval period, the archaeological evidence does not support a contemporary use of open-air water-boiling sites. The understanding of its use, however, and its survival in a literary sense, highlights the importance of oral traditions. This may have been why such later accounts by Keating were made more credible by the careful blending of the known with the unknown, retelling established stories from traditional placelore in his own style (Cunningham 2000: 133). Placelore was the crucial element that constantly linked the narratives back to territories and the peoples that inhabited them (*ibid.*: 136). Bradley makes the point that tradition can be invented and the past can assume the status of a myth. Origins were re-interpreted to fit changing political circumstances, to legitimise a political elite and lend authority of the past (1993: 119). The use of the past and of 'tradition' is usually selective and often articulated in the form of a myth or pseudo-history to justify contemporary actions and make sense of the present.

With some 1165 burnt mounds now excavated in Ireland, the important fact at the present time is that no sites can be securely dated to the medieval period. While some sites have the possibility of use in the medieval period, in each case there may be alternative explanations for the radiocarbon evidence. This does not support any claim for the survival of this tradition into historic times. The supposed dating of these sites to the Early Medieval period is based entirely on radiocarbon determinations, the great majority of which come from secondary activity in prehistoric burnt mounds or from sites that have an entirely different function. This is supported by the fact that artefacts of undisputed Early Medieval date have not been found in a primary context in any burnt mound in Ireland. It is also highly significant that pyrolithic activity is not recorded in ringforts or other settlements of Early Medieval date (Comber 2008). Furthermore, if burnt mounds were in active use during the Early Medieval period, why do they not feature in the early law texts, which surely would have commented on the practice? The main method by which meat was cooked in the medieval period seems to have been on a spit or griddle or boiled in a bronze or iron cauldron, a method mainly reserved for the higher social classes (Kelly 2000: 337).

It seems clear we should refrain from applying the term '*fulacht fia*' to dated contexts that have little or no resemblance to prehistoric water-boiling sites. The literary evidence, heavily embellished as it is, has been valuable in the sense of preserving the basic functional elements of these sites into modern scholarly experiments and interpretations. Even though oral tales may have undergone certain changes, a basic and ancient theme may have been preserved through later writings. They do not, however, describe a contemporary practice of open-air pyrolithic water-boiling. The technology must have been known in medieval times, therefore it is not surprising that older mounds of burnt material should prompt imaginative contemporary explanations (Waddell 2005: 34). The tradition of open-air boiling using hot stone for activities such as communal feasting, bathing, steaming and other possible industrial processes, seems to have died out in

Ireland in the mid first millennium BC. An oral tradition appears to have survived as part of a mythologized understanding of burnt mounds, which led to a certain degree of fanciful elaboration in later periods.

8.7 CONCLUSIONS

In summary, the use of burnt mounds, connected to pyrolithic water-boiling may be taken to indicate important social and ideological changes among small population groups during the Early Neolithic in Ireland. The excavation record from this period, in particular the butchered domesticates recovered from Clowanstown 1, Co. Meath, and the acts of commemoration identified at that site, strongly suggests that cooking was the first and primary function of burnt mounds in Ireland. The use of the technology for cooking is also found in some Late Mesolithic contexts, although these sites cannot be considered burnt mounds. The sophisticated and formal organisation of the Clowanstown mounds, their sustained use, separateness within the contemporary settled landscape, suggest that cooking here perhaps took place within a cycle of communal feasting. Instances where objects were placed into pits or other deposits must have been undertaken formally with a wider audience in mind (Jones 2013: 62).

Within two thousand years the technology began to be used over the entire island, possibly brought about by influences from a second wave of Atlantic contacts, this time from metal-using people. The rapid spread of pyroltihic technology owed much to their familiarity with pyrotechnologies, the steady increase in population and land-use intensification that was likely triggered by population growth in previously unoccupied areas. Surplus foods that require prolonged cooking or substantial processing were thus added to the diet and created greater calorific value than could now be extracted from meat and other foods by boiling. As places change in function and meaning over time, it must be acknowledged that the technology was not solely used for water-boiling at the same location for generations. Some pyrolithic practices are transient, others more permanent (see Chapter 5); but all leave their mark on the land however fleeting and ephemeral this may be. In this way, the technology is far from static, as is obvious with its use during the Middle to Late Bronze Age for sweat-bathing in small tented structures.

As outlined in Chapter 6, the rapid adoption of pyrolithic technology during the Bronze Age was not based on a search for more efficient cooking techniques, but rather in the social context of its use. If cooking is also the primary function of Bronze Age burnt mounds, it should not be viewed as a mundane undertaking, but rather one that actively contributed to the constitution of social relations. The duration and frequency of activities associated with burnt mounds and the opportunities they provide for social interaction suggest that they contributed some familiar frames of reference to contemporary discourse. As people took part in different roles in either the production, consumption and disposal activities on the site, those roles, their contributions and their return may have been a direct reflection of their wider social relationships and, in that way, their sense of identity.

Mounds are also closely linked to acts of memorial and the creation of place. In constructing a mound from the debris of the firing, rather than disposing of the material in discrete spreads practitioners were both drawing attention to the site, creating a sense of place, and creating a physical reference to the activities being carried out. Clusters of burnt mounds would have also transformed certain areas, adding to the visual distinctiveness of locales, creating unique places. Seen in this may, burnt mounds may have been associated with long term engagement with particular 'wet' places of the landscape, on the margins of settlement spaces that were 'remembered' as places of familial or communal gatherings for ancient cooking. Essentially, the cooking of meat in open-air water-boiling pits gradually declined, possibly being replaced by other forms of communal feasting during the Iron Age more concerned with status differences. It may also not have been relevant to societies developing needs, where a dairying economy eventually became more important. Direct, open-fire methods may have adequately fulfilled the cooking of small amounts of meat from animals selected for consumption during later periods. Over the years, these ancient mounds of burnt stone acquired many layers of meaning to eventually become mythologised places in the landscape.

Chapter 9

Reconsidering the burnt mound phenomenon

This final chapter discusses the contribution the study has made to research on burnt mounds and pyrolithic technology in prehistoric Ireland. The study provides a framework for future research on burnt mounds, raising several questions as to the significance and cultural context of these sites.

9.1 INTRODUCTION

In reviewing the excavation of burnt mounds in Ireland during the period 1950–2010, a number of research aims were identified (see Chapter 1):

(a) To consider the morphological characteristics of burnt mounds in relation to infrastructure archaeology.

(b) To analyse the chronology of the site type in light of new dating evidence

(c) To examine the use and social significance of the technology in Ireland

(d) To assess their settlement and cultural context.

Through an examination of available evidence for Irish *fulachtaí fia*/burnt mounds, several gaps were identified in our understanding of these sites within the archaeological record. The first task was to gather, review and analyse the excavation record of 1165 burnt mound sites excavated in Ireland to 2010. This indicates a significant increase in the number of known excavated burnt mounds since a listing of sites compiled in 2009 by John Ó Néill. The radiocarbon evidence for these sites confirms a broad chronology spanning some five millennia from the Early Neolithic to the High Medieval period. The wealth of new information provided by the 'grey literature' of recent unpublished excavation work made it necessary to re-examine burnt mounds to gain better understanding of the use of these sites in different periods. Due to the large volume of sites and the varying levels of information available from each excavation it was decided to examine four aspects in detail (see above):

(a) The study has demonstrated that certain limitations on the interpretation of site results can be attributed to the excavation and sampling strategies employed on infrastructural development schemes, as well as to the truncated nature of the archaeological remains. With regard to sampling strategy, the information obtained from 'associated feature' sampling is clearly more difficult to interpret than information from secure contexts. The time has come to reassess the excavation strategies employed at sites to maximise information retrieved and address outstanding questions. As Bradley (2006: 4) observed, 'field techniques have assumed a conventional character, so the people who use them may not realize that they were invented to answer specific questions whose details have now been forgotten'. The implications of formation processes are an important consideration in terms of the way in which the archaeological record is created. The destruction recorded at the majority of sites examined by infrastructure archaeology is striking. This includes the truncation of deposits as a direct result of agricultural practices and land drainage. In the face of land reclamation, re-use and agricultural destruction the study of burnt mounds takes on a renewed importance, as continued work of this kind may destroy these important indicators to prehistoric settlement in Ireland.

That said, the features excavated on some 900 sites in advance of these road/pipeline schemes have added to our understanding of site layout and challenged traditionally held views on the use of these sites. The variations in size and layout of burnt mounds may partly be explained by post-depositional disturbance and alteration in more recent times. At the same time archaeologists should be aware that the variations may be a manifestation of an adaptation of pyrolithic processes to changing functional demands, seasonal adaptations, local traditions or even the idiosyncratic tendencies of their users. We can no longer view these sites as simply representing water-boiling activities marked archaeologically by a trough and a mound of burnt stone. Additional features identified in recent years suggest the technology was used in a number of different ways, the water-boiling process being just one of these. These different uses have introduced variability to the archaeological record, where site features of similar type may relate to different activities.

(b) As outlined in Chapter 5, there has been a limited approach to dating at these sites with sampling methods not always capturing the entire history of a site. It has been demonstrated by radiocarbon dating that a number of sites may have had a prolonged duration of use. This, in turn, has led to uncertainty in the way in which some single dates should be interpreted. The problems raised by relying on a few or even just a single radiocarbon date to establish the longevity of occupation is obvious. This research has highlighted the need for a critical evaluation

of the radiocarbon evidence, in terms of sample quality and the contextual background.

Where secure multi-context sampling has been undertaken, the results confirm beyond any doubt that the use of pyrolithic technology was not solely a Bronze Age phenomenon. There is evidence for the use of such sites over four millennia, beginning possibly during the fifth millennium BC, with hot-stone cooking by Late Mesolithic groups. The use of burnt mounds for water-boiling does not appear in the archaeological record until the Neolithic, with the technology gradually becoming more widespread during the Bronze Age. A marked decline in the technology is evident in the Middle Iron Age, while a critical review of radiocarbon evidence suggests that a late Iron Age/early medieval burnt mound tradition is unlikely. The early dates associated with pyrolithic water-boiling and the deliberate mounding of that debris is important to our understandings of the origins of the technology. It implies that the water-boiling process was used for the cooking of domesticated animals and had a specialised role in these early societies, possibly used for ceremonial feasting. This suggests that new cooking techniques emerged as a clear consequence of the adoption of agriculture and animal husbandry in the fourth millennium BC.

Ireland now has possibly the most comprehensively dated corpus of burnt mound activity in north-west Europe, allowing unique insight into the origins, growth and decline of the monument type during the prehistoric period. This has allowed a detailed picture of burnt mound use in Ireland to be built up, which has important implications for similar research in Britain. Some sites there can now be confidently dated to the Neolithic, suggesting possible origins in this period.

The nature of mound deposits generated by the use of pyrolithic technology means that detailed stratigraphic analysis is not often possible. Evidence for multiple phases of use is seen mostly in the form of numerous pits and in the replacement, re-cutting and re-lining of troughs. The broader implications of these use-cycles was examined in this study, exploring the possible symbolic dimensions to site histories and internal phasing with the deliberate mounding of stone viewed as a creation of 'place' through culturally specific set of activities (see Chapters 5 and 7). It is argued that the re-lining and re-cutting of troughs within the footprints of earlier examples could even be linked to genealogical associations to previous inhabitation of the immediate area. It may have been this site history that made burnt mounds suitable focal points for later activity. This pattern of re-use and persistent remarking of an important place is consistent with evidence from many burnt mounds in Ireland that show periodic modification over time. As one observer observed, it is not too difficult to understand how monumental features continued to be relevant to the lives of later inhabitants of the landscape without necessarily having to invoke memory or myth, but it is more intriguing that smaller or less visible features were also bound up in such practices over time (Gibson 2013: 99).

It has been demonstrated in Chapter 5 that the meanings and memories associated with particular areas seem to have led to a prolonged use of some burnt mounds. Prehistoric communities may have inherited landscapes and perhaps ways of life from previous generations that continued and were adapted over longer periods of time. It is likely that local groups would have been aware through memory or oral tradition of the past significance of these sites. Clusters of burnt mounds in small areas may also imply an ancestral link or attachment to an area, with later generations of a family or a wider kin group returning there, but possibly using that location in a different way.

New occupants within an area would have brought the conscious memory of how to carry out such pyrolithic processes, but at the same time the physical evidence remaining in the landscape suggests that meanings associated with earlier use may have to be re-negotiated. As Chaffey and Barclay observe, this would require a conscious decision to either avoid or, in some cases, incorporate what was there before into the shaping of future landscapes (2013: 211). This is particularly interesting in the current study where earlier trough pits at a site were deliberately burnt, repaired or replaced. In some examples, new troughs were built over earlier examples, sometimes showing no resemblance to the previous structure. This might have been a result of a dislocation in the memories, meanings and values of what had gone before (*ibid.*: 208). Such re-visitations with earlier features would have invoked real or imagined memories of the landscape, which may have acknowledged their original meanings, while in others, those histories may have become forgotten or re-invented (*ibid*.). The most archaeologically visible act of remembering at these sites is the re-use of earlier troughs or the detection of deliberate deposits. Some examples of trough re-use may have provided a practical solution for water-boiling at a later date without the need to reconstruct a new trough. At other times, there was an abrupt break with what went on before, with the replacement of troughs using completely different methods of construction.

(c) A connection with cooking was the most popular interpretation of these sites prior to the present study. While this has been questioned by some, there is considerable archaeological evidence now to support early suggestions that burnt mounds were used as locations for the cooking of food. This is supported by experimental replication of site processes and more importantly by the growing number of animal bone assemblages from excavated sites. A review of ethnographic studies of hot-stone cooking provides useful comparisons, especially with regard to how unlined pits may have served as cooking facilities. This should not exclude a number of secondary uses, as the technology was also possibly connected with steam bathing during the latter half of the Bronze Age. It has been argued that the use of boiling troughs for the generation of steam in enclosed spaces is unlikely, with archaeological evidence instead

pointing to the use of hot stones and dry heat in small tented structures. Other interpretations of this technology, however feasible in modern terms, e.g. brewing, cannot be supported by any firm archaeological evidence.

The social aspects of these sites have also been considered in the study. Pyrolithic technology generally involved heating large amounts of water and the gathering of wood fuel and stones. This represented a considerable social investment, requiring both sustained human resources and substantial raw materials. While small deposits of burnt stone with associated pits may be typical of ad hoc cooking episodes representing a different scale of pyrolithic activity, the larger mounds are marked by a higher level of labour mobilisation, and possibly some degree of inter-group co-operation. Instead of isolated hunting camps, the majority of sites were probably located within the environs of a contemporary settlement. As a result it is possible to see the importance of the community in Bronze Age Ireland in the social dynamics of burnt mound use and their presence in the landscape.

It is difficult to make a clear separation of 'ritual' from 'non-ritual' in relation to burnt mounds and related sites in Bronze Age Ireland. All settlements of that period had particular religious observances and household rituals, which are very occasionally manifested in the archaeological record. With this in mind, it can be argued that the social role of these sites may have been extended at times to provide venues for ceremonial event where ritualised feasting took place at particular times of the year. These events could include a number of important occasions such as funerals, possibly supported by the spatial association of some burnt mounds and cremation pits. These special occasions may have warranted community/family gatherings for feasting and other purposes. The importance of such events is supported by evidence of specialised structures, large troughs, animal bone assemblages and deliberate deposits from a number of sites. The placement of some items at the base of troughs may be significant. This could have been a very public act that altered the perception and social significance of the site. These deposits were clearly a means to 'close off' the site permanently where the trough could not be used again. Pre-trough deposits noted at other sites could also be related to foundation offerings, although these are rarer in the burnt mound archaeological record.

(d) It is clear that burnt mounds did not exist in isolation in the wider settlement landscape. Despite the evidence indicating a less intensive use of these waterlogged locations, the surrounding area is believed to contain further evidence of the community concerned. The identification of contemporary burnt mounds within several hundred metres of habitation areas indicates that the former were used on a small familial or kin-group basis. These activities probably grew to symbolise and create social relationships through cooking, thus maintaining a sense of group identity.

As the use of pyrolithic technology was a recurring activity in many areas, the regular use of burnt mounds was a common practice of many people's lives. In that sense, these locations may represent significant zones in which social processes took place within the contemporary landscape. The recovery of domestic material culture from many excavated burnt mounds confirms that they were an integral part of the settlement pattern. The identification of many burnt mounds within 1km of known Bronze Age settlement is also significant and the shared abandonment or 'closing' ceremonies now apparent in both settlements and burnt mounds lends further support to their relationship with settlement patterns. Taken as a whole, the surviving evidence for votive activity at burnt mounds is roughly comparable to habitation sites both in form and frequency. Where a case can be substantiated for votive deposition at burnt mounds, that activity is broadly analogous to habitation sites, which represent another part of the contemporary lived-in landscape where people spent significant parts of their daily lives. Through their use of these sites communities were creating a sense of place not only in the deposition of mound material and the renovation and re-cutting of troughs, but also in their engagement with the wider landscape. Their size suggests that they were the focus of relatively small groups, providing the context for gatherings of kin and neighbours to prepare and share food as part of a regular social round. At another level, the burnt mound was probably an important symbol of group identity for local populations. The monument contributed to the symbolic use history of their community in a particular location through its presence in a resource-rich locality. Emphasis should therefore be placed on their role as an internal symbol of community, for multi-family groups bound by close lineage relationships, where public cooking and feasting promoted social cohesion.

9.2 THE *LONGUE DURÉE* OF BURNT MOUNDS IN IRELAND

The widespread distribution of burnt mounds suggests that many prehistoric groups in Ireland were prolific users of pyrolithic technology. The large numbers of burnt mounds and the apparent frequency of their use suggests that a large proportion of the contemporary population must have been reasonably familiar with the activities that took place there. In that respect, the use of burnt mounds was a common tradition across the diverse groups and social territories of late prehistoric Ireland. The rapid spread of pyrolithic processes owed much to their familiarity with pyrotechnologies, a steady increase in population and intensification of agriculture leading to expansion of settlement to previously unoccupied areas. The expansion of farming created large amounts of surplus foods that require prolonged cooking or substantial processing. As outlined in Chapter 6, however, the rapid adoption of pyrolithic technology during the Bronze Age was not based on a search for more efficient cooking techniques, but rather in the social context of its use. If cooking is also the primary function of Bronze Age burnt mounds, it should not be viewed as a mundane undertaking, but rather

one that actively contributed to the constitution of social relations.

As outlined by Ó Néill (2009: 197), a review of the technological processes involved in the use of pyrolithic technology provides a clearer framework within which burnt mounds might be understood. As the earliest use of this technology is associated with cooking, it seems likely based on increasing faunal assemblages (outlined in Chapter 6), that this was their main purpose throughout the Bronze Age. Ethnographic studies of hot-stone cooking features provide useful data on how unlined pits may have been used for cooking. In roasting or oven processes, such as those commonly identified on continental Europe and North America (Chapter 3), heat is transferred by placing stones in immediate proximity to a fire. In other situations, stones were heated in a nearby hearth and subsequently placed in the pit. Most common in the Irish archaeological record is a heat transfer whereby the energy released from wood fuel as heat during combustion is concentrated in stones and then transmitted to liquid for various processes. Understanding the type of cooking depends on an ability to differentiate between different types of heating process, such as heat transfer by moisture where the heat is transferred through water, and dry heat where the heat is transferred through the air, as in an earth oven or roasting pit. As such, the most identifiable materials associated with pyrolithic technology are deposits of thermally altered stone and one or more pits associated with dry heat or water-boiling. In light of recent excavations, two main variants can be identified: burnt spreads/mounds that have troughs and those examples that do not. The former can be subdivided into sites with single troughs, multiple troughs, connected troughs, troughs with structures or sites with single pits, no pits or multiple pits (see Chapter 4). This allows distinctions to be drawn between the different types of site employing pyrolithic technology.

It may be that the variability of burnt mounds is not adequately reflected within basic site classifications. The available evidence makes an understanding of individual sites difficult for a number of reasons, including single radiocarbon determinations, the disturbed nature of the archaeological record and limitations with respect to excavation extent. Notwithstanding this, there is a reasonably strong case to argue that some had different uses from others, and that this is not a clearly defined monument type but one with considerable variability in terms of practices and features. As places change in function and meaning over time, it must be acknowledged that the same technology may not have been solely used for water-boiling over time at the same location. Some pyrolithic practices were transient, while others were more permanent (see Chapter 4) and left a strong physical trace. Taking into account site disturbance and partial excavation, it is apparent from infrastructural development that a high percentage of burnt stone deposits never accumulated to such a height that they should be referred to as 'mounds'. The recent archaeological record confirms that there is a clear distinction between the heating of water and dry roasting as once-off episodes leaving perhaps solitary pits with no related spread of burnt stone, and the formalisation of such a sites as 'monument' that is intentionally defined, used, revisited, and sometimes redefined over a period of time. It may be that discrete mounds of burnt stone represent both a prolonged use of a burnt mound over time and a deliberate attempt to monumentalise a site.

As outlined throughout the study, there is growing evidence that pyrolithic technology may have been used for small-scale cooking using dry heat during the latter half of the fifth millennium BC. At present, there is no evidence that hot stones were used for water-boiling during this period as no convincing water receptacles have been uncovered. There is also no burnt mound occurrences comparable to later prehistoric examples. The deposits of burnt stone recovered from these sites are best described as small spreads or dumps derived from a cooking-related activity and not accidental burning from adjacent fires. It is possible that a cooking pit or hearth lay beyond the limits of these excavations. Alternatively, shallow pits may have been used for roasting or steaming and many of these may not have survived archaeologically, especially in coastal areas where many of these deposits have been uncovered (see Chapter 5 and 8). It is conceivable that the archaeological remains at these Late Mesolithic sites represent local gathering points on the coastline or foreshore of a large body of water where people regularly returned to over periods of considerable time for seasonal cooking. There are no occurrences of shell midden deposits at burnt mounds in Ireland, however hot stone processes seem to have been used in some Late Mesolithic shell midden sites. Interesting, the possibility of a pyrolithic tradition in Mesolithic Ireland would indicate that the earliest use of the technology was for cooking.

While a version of the technology may have been employed for dry roasting/baking during the fifth millennium BC, the use of pyrolithic water-boiling technology did not become common in Ireland until the Neolithic period. This is based on the identification of trough pits and domesticated faunal remains in excavated burnt mound/spread sites dating from the early fourth millennium BC. This suggests that new cooking techniques emerged as a clear consequence of the adoption of animal husbandry. The animal bone recovered from early pyrolithic sites was dominated by cattle remains. This supports a possible cooking function associated with the beginnings of a pyrolithic water-boiling technology. It is also evident from the record that smaller sites employing the technology for shorter episodes of use were also in existence. While sites may have the same primary purpose, some could have occupied very different positions within the community. For the most part, the evidence suggests a limited development of specialised 'burnt mound' areas for pyrolithic water-boiling associated with the butchering and cooking of domesticated animals. The technology at that time may have been connected to communal feasting with ritual associations, a trend that continues to be important into the Bronze Age. This advanced further during the Late Neolithic when the use of timber-lining in troughs led to

a more prolonged and efficient process of water-boiling, where areas were specifically chosen so troughs would fill naturally with water.

In constructing a mound from the debris of the firing, rather than disposing of the material in discrete spreads, the users of burnt mounds were creating a sense of place with a physical reference to the activities be¬ing carried out. Clusters of burnt mounds would have also transformed certain spaces into unique places where a multiplicity of low mounds added to the visual distinctiveness of locales, creating unique places. Seen in this way, burnt mounds may have been associated with long term engagement with particular 'wet' places of the landscape, on the margins of settlement spaces that were 'remembered' as places of familial or communal gatherings for ancient cooking. That said, these locations were generally not considered appropriate for the interment of human remains even as closing deposits.

During the Chalcolithic and Bronze Age periods there is evidence for large-scale use of the technology over the entire island. It is possible that the widespread use of pyrolithic technology and burnt mounds during that time may have been a result of an expansion of exchange networks associated with the spread of Beaker material culture. While the Neolithic marks a considerable change in the application of the technology (i.e. water-boiling), advancements during the Early Chalcolithic are evident in the refinement of this technology, particularly with the addition of timber and wattle trough linings. It is argued that these allowed for a more efficient method of water-boiling, maintaining the integrity of the pit in wet ground conditions and facilitating the regular emptying of heat-shattered stone from the trough. In addition, water-drainage features begin to be used during this period, revealing a new expertise in the management of ground conditions and water supply. An important development in recent years is the growing number of burnt mound excavations that have produced animal bone from Chalcolithic and Bronze Age contexts. While much of this material is fragmentary, larger animal bone assemblages at a number of sites have contributed significantly to our understanding of burnt mounds as possible cooking-places. Assuming that the representation of faunal remains reflects the economic and dietary situation, there is a clear indication of the importance of domestic cattle in the local economy during the Bronze Age. Even though cattle dominate the bone assemblage from excavated burnt mounds in Ireland, it is generally not the only species present, with other domestic and wild animals used for food consumption during the Chalcolithic and Early Bronze Age period.

The concentration of burnt mound sites from the Middle-to-Late Bronze Age corresponds with a general trend in settlement expansion during the later second millennium BC. This period marks another considerable change in relation to trough form, with the first use of hollowed-out logs and re-used canoes for water-boiling. While the use of plank-lined troughs continues, wattle-lined examples are abandoned. Roundwood begins to be used in trough construction and the first use of stone for linings appears *c.*1400–1200 BC. This reveals the use of specialised cooking structures using pyrolithic technology possible for the large-scale consumption of food. It is clear from the archaeological record that some burnt mound sites may have been used as sweatlodges, highlighting another variant on the use of pyrolithic technology. These examples, however, should not be referred to as burnt mounds, a term now reserved for pyrolithic water-boiling sites connected to cooking. They should also be regarded as different from the far greater number of hot-stone/water-boiling sites used particularly for cooking, for which the term *fulacht fia* remains suitable, particularly in an Irish context. The term 'burnt mound' usefully describes a category of sites with similar surface appearance and many common excavated features, but which include both sweatlodges and *fulacht fia* cooking sites (Figure 9.1). Whether the term 'burnt mound' also includes a third group of site with specialised, 'industrial' functions (brewing, dying, fulling etc.) remains to be confirmed.

In contrast to the preceding Bronze Age, the evidence for Iron Age pyrolithic activity is limited in scale. The study has found, through a critical review of the radiocarbon evidence, that burnt mounds ceased to be used in Ireland during the Early Iron Age, sometime around 400 BC. During the Middle Iron Age, in some areas, there is tentative evidence of an enduring burnt mound tradition, albeit one that sporadic and short-lived. The end of this tradition should not be conceived solely in terms of the cessation of pyrolithic technology, but rather in a changing pattern of open-air, family-based cooking and the introduction and eventual dominance of a dairying economy. While burnt mound locations may represent a shared ideology, which brought household groups together as part of a symbolic construction of community, the situation would have changed significantly with the advent of Christianity in Ireland and the introduction of a developed arable agriculture, mobile pastoralism and dairying. The earliest instances of bog butter in Ireland is dated to the Middle Iron Age, a phenomenon that becomes increasingly popular during the early medieval period for storing butter (Earwood 1997; Downey *et al.* 2002). The pollen records from this period also reveal limited impact on the landscape from farming activity, accompanied by woodland regeneration in some areas (Lynch 1981). To date, there are no Bronze Age examples of bog butter in Ireland, implying that there was a shift in agricultural methods towards an increased dependence upon pastoralism and dairy products. This change is reflected in the importance accorded to cattle, the normal currency of the Late Iron Age in the early Irish law texts (Kelly 2000). Whilst previous studies have accepted radiocarbon evidence that burnt mounds continued to be used in Ireland during the early medieval period, this study has confirmed that this was not the case. All such dates are problematic and the important fact is that no sites can be securely dated to the medieval period. It seems apparent that these prehistoric sites became mythologised in later

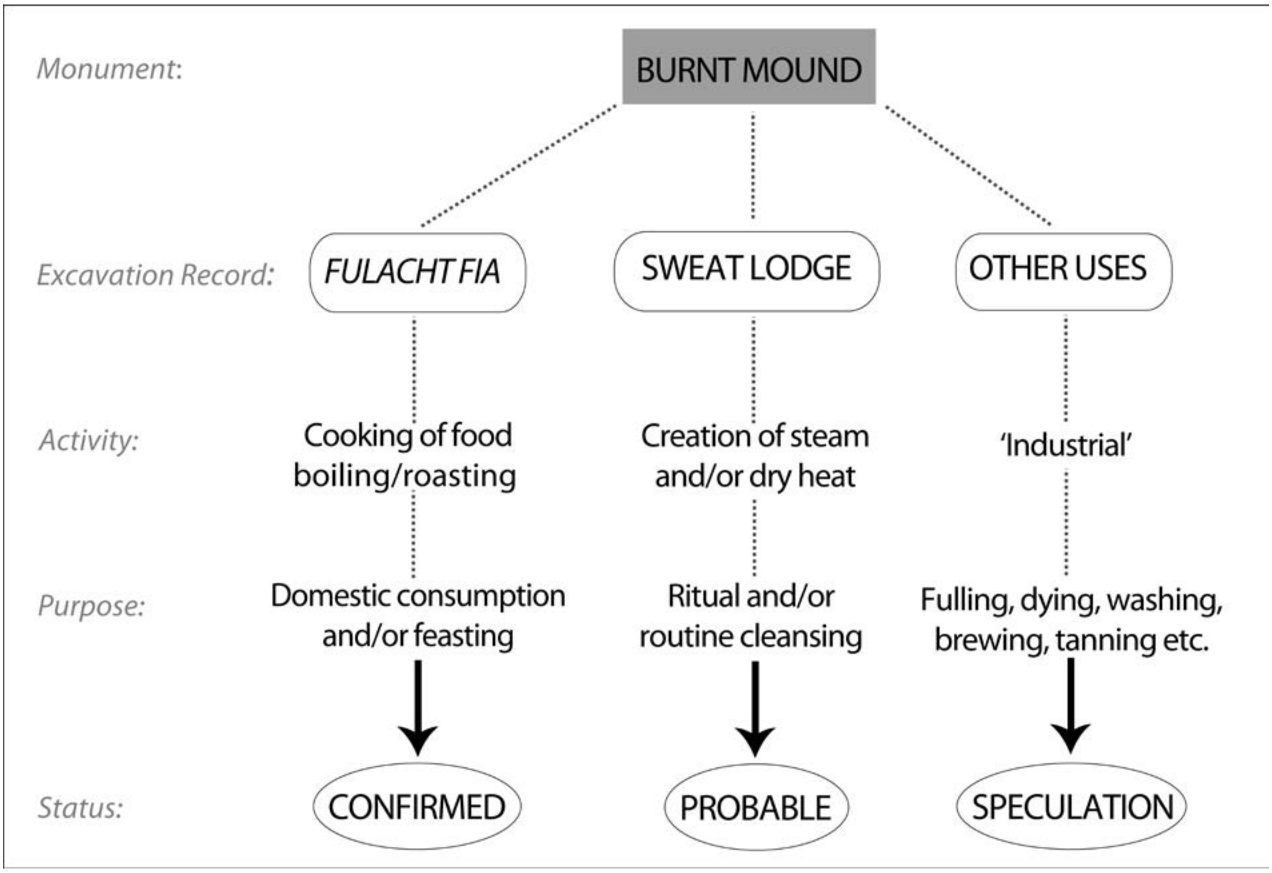

Figure 9.1. Classification of terminology used in relation to prehistoric burnt mounds and their sub-types.

periods, accounting for the terminology adopted and how they became romanticised in much of the literature.

9.3 BEYOND THE BOOM: THE FUTURE OF BURNT MOUND RESEARCH

With regard to future research into burnt mounds, the present study has highlighted a number of key areas (see Chapter 3). In light of many problematic radiocarbon results there is a need for better sampling strategies in excavations. A discussion of chronology has moved away from a consideration of the overall date range for burnt mounds to understanding of longevity of site use. The absence of obvious stratigraphy in many burnt mounds has been one of the reasons why some archaeologists and planning bodies/developers have been somewhat dismissive of burnt mounds. The level of interpretation is often dependent on the complexity of an individual site. Detailed sampling at a number of sites has shown successfully that age variation within mounds can be detected and quantified through the use of careful dating (see Chapter 4). The resolution of site chronologies will, however, depend on both the number of samples taken, and the secure nature of the sampled contexts.

Several new directions for research have been identified in recent years. The homogeneity of the burnt mound deposit at a site in the Norfolk Fens of East Anglia was such that divisions between individual burning and dumping episodes were not possible. Soil micromorphology demonstrated episodic build-up of burnt material, indicative of repeated visits rather than sustained occupation (Crowson 2004: 34). The succession of cut features and the breaks observed in the mound formation demonstrated that the site was probably revisited a number of times, more likely through seasonal activity and renewal rather than sporadic use over an extended period (*ibid.*: 37). This excavation strategy, along with the adoption of soil micromorphology, has yet to be undertaken in an Irish context, but it is one which could be highly beneficial where distinct dump layers are indistinguishable. This type of analysis can be accompanied by a programme of fine-resolution radiocarbon dating of charcoal fuel residues to investigate the time-scale over which a burnt mound accumulated.

As outlined in Chapter 6, it would also be interesting to undertake more detailed sampling of trough timbers in order to establish construction dates for sites. As many sites are uncovered as dispersed spreads of burnt stone, the selection of samples from secure contexts is important. Another important factor in the dating of burnt mounds is the degree of association between the sample and the context being dated (see Chapter 5). For instance, a recent study has demonstrated that a significant portion of later prehistoric radiocarbon dates from both commercial and other excavations are problematic in terms of their sample

and/or association quality (Becker *et al.* 2012). This is also true of a number of burnt mounds in this study that have returned both early Mesolithic and medieval radiocarbon dates (Hawkes 2012; see Chapter 5).Where these do not survive, primary trough fills should be selected for dating, especially where a number of these are revealed. This may help to distinguish chronologically between groups of mounds and features.

In discussions relating to the chronology of these sites, it may appear unusual that dendrochronology has not been a standard means of dating given the large amounts of waterlogged wood often found. Unfortunately, this has proven to be a problematic for most burnt mounds as the surviving pieces of timber tend to contain rather short tree ring sequences, making many correlation with regional master sequences problematic (Baillie 1990). Dendrochronology also suffers from limited applicability in Ireland where it can only be applied the dating of oak and requires long-lived and preferably replicated ring patterns. The basic reference chronology for the application of dendrochronology was constructed in the north of Ireland and while there has been success in dating trough timbers in other regions against the Belfast master, some timbers have proved to be problematic. As observed by Baillie, even if the timber from a trough is oak, it is likely to represent a single tree or a very small number of trees with ring patterns of only marginal length and is most likely to derive from an area outside the north of Ireland (1990: 167). Despite these problems some sites have successfully been dated through the use of dendrochronology, particularly hollowed out tree trunks and dug-out canoes used as troughs as these are effectively 'sing timbers' with long lived tree records. Troughs dated by this method in Ireland would include examples at Drumbo, Co. Cavan (CN04), Baloo Lower, Co. Down (DW10), Clonaddadoran, Co Laois (LS02), Killoran 27, Co. Tipperary (TY16), and Killalough, Co. Cork (CO21).

Luminescence dating (optically stimulated and thermo-luminescence methods) is not widely utilized in the field of burnt mound archaeology and has not been applied in Ireland to date. With the exception of two burnt mound sites on mainland Scotland, the technique has been confined to use on the Orkney Islands, most notably by Huxtable et al (1976). It has also been used to some degree in dating burnt stone deposits in Scandinavia (Larsson 1990). All luminescence dating techniques are based on the principles of an accumulation of stored energy trapped in the crystal lattice of certain minerals, built up as a result of exposure to background ionizing radiation (Anthony 2003). The potential of luminescence dating to provide chronological information on site duration of individual burnt mounds has been raised (Anthony *et al*. 2001; Anthony 2003). It has been outlined as a method suited to determining the age of both excavated and unexcavated sites, and to tackling issues of site formation. Detailed sampling at a number of sites in the Scottish Isles has shown successfully that age variation within mounds can be detected and quantified through the use of luminescence dating. Provisions for luminescence dating and its associated sampling could be embedded into excavation planning and operation from the outset to achieve effective dating results where stratigraphic sequencing is lacking. The particular advantage of luminescence dating is that it provides a date for the archaeological artefact or deposit itself, rather than for organic material in assumed association. The method is, however, in its infancy in Ireland and can only be used in conjunction with other scientific dating methods due to problems associated with site truncation. All these considerations have tended to confirm the consensus that radiocarbon dating is the most appropriate dating method for these sites.

To develop detailed site chronologies, a sufficient number of samples with clear stratigraphic relationships will permit the use of Bayesian calibration techniques (Barratt and Reimer 2007: 8). Bayesian modelling makes use of additional information in the interpretation of a series of radiocarbon determinations, in order to improve the accuracy and precision of the results (Schulting 2011: 145). In the absence of any firm stratigraphic relationships, the coherence of the dates themselves is used to constrain their calibrated start and end ranges, assuming that they can reasonably be attributed to a more or less 'continuous' phase of activity. Equally, if clear stratigraphic sequences can be identified at a burnt mound, the archaeological stratigraphy can be used to reduce the uncertainty in both individual calibrated radiocarbon dates and the overall sequence of events, by taking into account the obvious fact that samples lower in the sequence will be earlier than those higher in the sequence, assuming that there is no disturbance (*ibid.*). This, combined with the radiocarbon dating of trough timbers, will provide finer site chronologies that should reveal the temporality of burnt mound use.

It is also essential to accept the limitations imposed by archaeological methodologies, such as the difficulty in establishing the length of occupation. For example, a site could have multiple lifecycles that may not always be recognisable, particularly if later disturbance has destroyed the evidence, which is a common situation amongst many of the sites examined in this study. The selective use of datable material can also be a limiting factor in determining the true longevity of occupation, particularly where only a few samples are available. Awareness of these limitations when interpreting the archaeological record is essential to understand the complexity of burnt mound sites and the multiple meanings that can be assigned to different contexts and deposits.

As outlined in Chapter 3, in many cases, the surviving remains of a burnt mound can be quite limited, especially when uncovered as part of road or pipeline scheme. The recovery techniques such as topsoil stripping can also be damaging to sites, particularly those that have been previously levelled in antiquity. Upper layers of burnt mounds can be damaged, troughs truncated and other stone structural features completely removed. In

some cases burnt mound material is even removed by machine during the excavation stage. This is probably more widespread during rescue excavation due to time constraints, however, the uniformity of burnt mound material in most cases and general absence of animal bone and artefacts has led to a general view that these sites will produce little in terms of cultural material. This has led to a circular argument where burnt mounds do not produce material of significant interest, and is why they are not often excavated in a comprehensive way. The troweling of burnt mound material is therefore not generally practiced with most sites excavated using mattocks and shovels. As a result, small finds and more importantly, fragmentary faunal remains can be overlooked and it is often this waste-firing material where many such remains would normally have been deposited during the use history of the site (see Chapter 6). Interpreting the complex inter-relationships of site features and material culture is also important to understand the way formation processes influence what comes down in the archaeological record. In this regard, where pits/troughs display evidence of being intercut, there is often little attempt to distinguish particular phases. This is one of the main ways of understanding the use history of a burnt mound site since it is often difficult to stratigraphically relate nearby cut features.

With regard to advancing our current interpretations as these sites as cooking areas, lipid analysis may be a useful approach in certain circumstances, particularly where final trough deposits are found in situ. Given the degraded and truncated remains of many trough pits found in recent years, selecting suitable samples for lipid analysis has been problematic. A more successful approach may be to sample structural timbers from well-preserved timber troughs in an attempt to extract trapped animal fats. As discussed in Chapter 6, it is also possible that lipids may become trapped within the heated stone itself during the process as they would often be in direct contact with the meat itself or the fats which are being expressed. For instance, in 2017, the author, in collaboration with Professor Mary Malainey (Brandon University) conducted a pilot lipid study funded by the Royal Irish Academy. Two fire-cracked stones of different geologies were selected from the base of an Early Bronze Age wattle trough (Hawkes 2017; Figure 9.2; Figure 9.3). The process works by grinding off the exterior surface of the stone to remove any contaminants. Samples are then crushed and absorbed lipids are extracted with organic solvents. The fatty acid components of the lipid extracts are then analysed using gas chromatography. Interestingly, both samples contained traces of lipids, with one containing high levels of animal fats from a large herbivore (Malainey and Figol 2017). This suggests that there is considerable potential in the identification of plant chemical signatures and microfossil lipids on fire-cracked stone associated with pyrolithic features.

Undertaking more extensive excavations and more rigorous radiocarbon dates of burnt mounds will assist placing these sites in a proper chronological and geographical context. The absence of an appropriate research framework for the selection of sites for excavation has also been highlighted as a potential problem in the search for a greater understanding of these monuments. Therefore, selecting extant burnt mound sites for research excavations may be a worthwhile pursuit allowing more appropriate research questions to be asked prior to investigations. In these scenarios, time may allow for more detailed sampling strategies to be employed during excavation. Proper funding may also allow for more detailed analysis such as petrology identifications, lipid and soil micromorphology. The various methods and approaches of environmental archaeology may also be of great use in research-based excavations. An extension of geochemical and geophysical analyses might identify additional activity areas, arable fields and habitation sites. The latter may be particularly useful as it has been demonstrated elsewhere that nearby activity areas/settlement habitation may be detected. By their nature burnt mounds, comprising vast quantities of fire-cracked stones, are ideal for investigation by magnetometry. The fire-induced magnetism results in strong anomalies that are readily detectable by gradiometers (Monaghan 1995). Geophysical surveys on and in the vicinity of a large burnt mound at Shelly Knowe, Shetland, revealed roundhouses in the immediate vicinity. Several roundhouse structures were identified within 50m of a burnt mound site identified as 'Mound 24' (Dockrill *et al*. 2007: 120−135). By extending the survey beyond the 'site', information can be obtained about its context and setting, and its possible relationship with other sites.

Another method that could provide additional data on the development of human settlement in an area is palynology. Pollen analyses on sediments from bogs or lakes can provide chronological control and additional data concerning the establishment of arable agriculture. As artefacts and other ecofactural material is not always forthcoming during excavation, it is necessary to rely on other forms of evidence that might allow a greater understanding of the economic, social and cultural roles of burnt mounds. In the case of some specific sites in this study, this evidence was sought and obtained via a range of palaeoenvironmental analyses. Site-specific pollen studies have the potential to answer many questions concerning human impact on burnt mound environments, as well as an understanding of local agricultural practices. Analysis of peat samples for insect and plant macrofossil remains will illustrate in more detail the character of on-site environments and provide evidence of agricultural activity that may be associated with the burnt mound. An example is a study undertaken at Killescragh, Co. Galway, where the combined palaeoenvironmental records show the presence of multiple tree, shrub and herb species suggestive of a wet-dry mosaic (Bermingham 2009). Also present in this environment were dung beetles species, all of which were common to the dung of domestic mammals, such as herbivores. Animals, presumably belonging to the people who used the burnt mound, may have freely grazed in and the around the site. The environmental record of that site certainly shows that human groups were exerting a tangible impact on the surrounding landscape,

Figure 9.2. Early Bronze Age wattle trough sampled for lipid analysis at Errarooey More, Co. Donegal. Source: Alan Hawkes

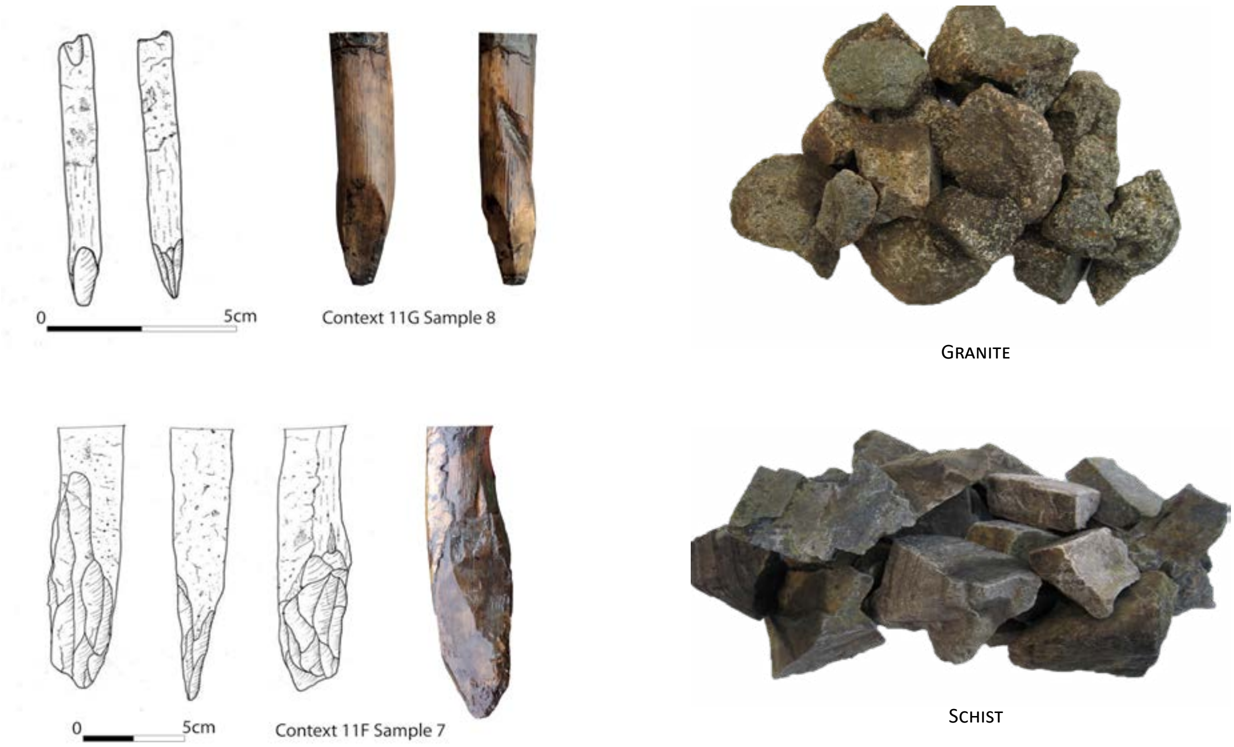

Figure 9.3. Worked hazel ends (left) and Selection of heat-altered stone from trough (right) at Errarooey More, Co. Donegal. Source: Alan Hawkes

with a decline in woodland and an increase in grassland connected to animal grazing.

Environmental studies relating to burnt mounds often concentrate on wood species as charcoal survives in abundance, providing additional information on the composition of the local woodland that may have been used for fuel and trough structures. Pollen evidence of deforestation at a number of burnt mounds in the west of Ireland (Brown and Hatton 2004: 3) and Britain (Bates and Wiltshire 2001), suggest that these trees and shrubs may have been uprooted or felled deliberately during field clearance to provide fuel for the burnt mounds. Recognising the unique value of other environmental preservation stored in wetlands, however, can establish the environmental setting and observed human impact upon it over time. While pollen studies along with species identified in the charcoal during excavation provide evidence of the local woodland species, plant macrofossil analysis from the same samples can suggest whether this was a wet or dry area inhabited by species indicative of these environments. The recovery of cereal remains in pollen sequences may also indicate if farming was indeed practiced in burnt mound locales.

The future lies in multi-strand approaches to the investigation of burnt mounds, combining a range of environmental and archaeological methods. As outlined in Chapter 3, archaeologists can probably excavate another thousand of these sites without ever gaining more information than what is already available as long as the traditional method of simply removing archaeological contexts and recording their superficial morphology remains unassisted by the methods of more specialised disciplines.

Closing comment

This book has provided detailed description and interpretation of burnt mounds and pyrolithic technology in Ireland. The analysis is based on 1165 sites excavated between 1950–2010. This number will increase during future road and pipeline developments in Ireland, and so it is too early to present a definitive statement on the site type. Our understanding of burnt mounds and how they operated in the daily life and work routines of Bronze Age society must also be placed against the nature of excavated evidence of recent years. Archaeological excavation of burnt stone sites in Ireland has largely focused on the results from road and pipeline developments where sites have been severely damaged. However limited, these investigations have raised several issues with regard to the use of pyrolithic technology in different social settings in prehistoric Ireland. In the past, function was often conceived in terms of the evidence provided from the early literary sources, however there is now considerable archaeological evidence to support early suggestions that burnt mounds were indeed used as cooking areas. While the study has predominantly considered cooking as the primary purpose of burnt mounds and pyrolithic processes in prehistoric Ireland, other interpretations have emerged in recent years. The difficulty is that many of these cannot be supported by any firm empirical evidence, and through reiteration in the literature many archaeologists have come to accept these ideas as established fact. The results from this study strongly suggests that cooking was a primary function of the great majority of prehistoric burnt mounds in Ireland. The formal organisation of some sites, their sustained use and separateness within the contemporary settled landscape, suggests that cooking perhaps took place within a cycle of feasting events and not as a daily routine. Instead of isolated hunting camps, we can argue that these sites were located within the environs of contemporary settlement, with the occupants returning regularly to these locations as part of well-established routine. For this reason, burnt mounds must be regarded as highly significant locations in the symbolic construction of community in late prehistoric Ireland.

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Appendix 1

Additional tables

The following tables provide supplementary data for the main text. All radiocarbon dates are calibrated to 95.4% confidence level using the Oxcal 4.2 software (after Bronk Ramsey 2013). The 'reliability' column from Figure 10.7 onwards is based on the degree of certainty of the dated sample and its association with pyrolithic activity (see Chapter 5).

Figure 10.1. Stone-lined troughs with dating evidence from excavated burnt mounds in Ireland.

Cat No.	Site	County	Shape	Lining	L (m)	W (m)	Depth	Date
CO97	Macroney Upper	Cork	Sub-cir	Poss.	1.36	1.15	0.48	1735–1537 BC
KK14	Ballynamona	Kilkenny	Sub-rect	Y	2	1.6	0.55	1634–1507 BC
CO98	Castlecooke	Cork	Rect	Y	2.5	1.4	0.62	1625–1513 BC
KK33d	Ballyquirk	Kilkenny	Sub-rec	Y	2.4	2.1	0.54	1617–1494 BC
LK62	Brackbaun	Limerick	Rect	Y	2.8	1.5	0.6	1634–1454 BC
KK16	Ballmountain	Kilkenny	Rect	Y	2.88	1.05	0.3	1536–1422 BC
TY34	Clonmore North	Tipperary	Rect	Y	2.48	1.24	-	1525–1412 BC
LK52	Leahys	Limerick	Rect	Poss.	3.5	1.5	0.5	1520–1390 BC
CO57	Garranes	Cork	polyg	Y	1.32	1.3	0.4	1493–1311 BC
CO13	Dromnea	Cork	Rect	Y	2.15	1.25	0.8	1440–1260 BC
KY10d	Ballydowney	Kerry	Rect	Y	2.5	1.8	0.55	1490–1200 BC
CE04	Clonmoney North	Clare	Oval	Poss.	3	2.3	0.7	1490–1200 BC
TY39	Gortybrigane	Tipperary	Sub-cir	Y	2.72	2.44	-	1403–1262 BC
CE23	Cahiracon	Clare	Sub-rect	Y	1.8	1	-	1520–1120 BC
WD15	Killoteran	Waterford	Oval	Y	1.4	0.25	0.17	1490–1120 BC
CO54	Scartbarry	Cork	Rect	Y	4.9	1	0.67	1440–1020 BC
CO81	Carrignafoy	Cork	Sub-rect	Y	5.18	1.5	0.7	1440–1020 BC
MO69	Cloonmeen West	Mayo	Rect	Y	2.6	1.8	0.45	1390–1054 BC
RM17	Bockagh	Roscommon	Rect	Y	2.32	1.1	0.3	1258–1130 BC
RM10	Currinah	Roscommon	Square	Y	1.94	1.88	0.38	1306–1005 BC
RM19b	Bockagh	Roscommon	Oval	Y	1.8	0.8	0.33	1208–1012 BC
CO53	Lisnagar Demesne	Cork	Rect	Y	2.3	1.5	0.35	1140–920 BC
KY03	Coarhamore	Kerry	Rect	Y	2.74	2.32	0.65	960–930 BC
LS33	Cuffsborough	Laois	Rect	Poss.	2.92	2.05	0.29	1010–830 BC
LM12a	Errew	Leitrim	Sub-circ	Y	1.4	1.4	0.35	1000–830 BC
CE38	Cahiracalla Beg	Clare	Rect	Y	1.8	0.9	0.45	1000–820 BC
RM09	Currinah	Roscommon	Rect	Y	2	1.34	0.32	839–799 BC
CO96	Curragh Upper	Cork	Rect	Y		0.9	0.4	829–787 BC
MO62	Cashelduff	Mayo	Sub-rect	Y	3	2.41	0.38	793–553 BC
CO71	Ballinglanna North	Cork	Rect	Y	2.2	1.8	0.8	766–524 BC
LK63	Brackbaun	Tipperary	Rect	Y	2.8	1.5	0.6	789–425 BC
CO07	Drombeg	Cork	Rect	Y	1.5	1	0.56	770–400 BC
CE36	Shannakea Beg	Clare	Sub-rect	Y	0.92	1.35	0.25	761–393 BC
CO94	Coolmoohan	Cork	Rect	Poss.	5	1.55	0.6	1119–937 BC

FIGURE 10.2. SURVIVING ROUNDWOOD-LINED TROUGHS EXCAVATED FROM BURNT MOUNDS IN IRELAND.

CAT NO	SITE	COUNTY	SHAPE	LINING	L (M)	W (M)	DEPTH	STAKES	DATE
KK26A	ISLANDS	KILKENNY	CIRC	Y	1.86	1.84	0.4	NO	2870–2490 BC
MH31B	BALLINTER	MEATH	OVAL	Y	1.4	0.75	0.3	NO	2620–2470 BC
KD21	MULLAMAST	KILDARE	RECT	Y	1.55	1.3	0.25	YES	2550–2530 BC
MO25	ATTIREESH	MAYO	SUB-RECT	Y	1.36	1.3	0.33	YES (6)	2575–2351 BC
MO30	GORTAROE	MAYO	SUB-RECT	Y	1.3	0.9	0.3	NO	2465–2299 BC
MO16	DEERPARK EAST	MAYO	OVAL	Y	1.62	0.96	0.38	YES	1879–1691 BC
MO56	SONNAGH	MAYO	RECT	Y	2	0.8	0.3	YES (2)	1660–1527 BC
MO48A	SONNAGH	MAYO	SUB-RECT	Y	3.6	2.55	0.5	YES (1)	1492–1413 BC
CE61	SRANAGALLOON	CLARE	RECT	Y	2.7	1.8	0.2	NO	1494–1324 BC
MO52	SONNAGH	MAYO	RECT	Y	2.4	1.3	0.45	YES (13)	1401–1294 BC
GY18	KILLESCRAGH	GALWAY	RECT	Y	0.9	0.55	0.15	YES (17)	1394–1132 BC
MO50	SONNAGH	MAYO	RECT	Y	2.5	1.6	0.5	YES	1368–1132 BC
CO09	KILCOR SOUTH	CORK	SQUARE	Y	1.41	1.45	0.5	YES	1300–1170 BC
TY01	DERRYFADDA	TIPPERARY	RECT	Y	2.4	1.76	0.6	YES (4)	1400–990 BC
MO24	ATTIREESH	MAYO	RECT	Y	1.5	0.9	0.18	YES (3)	1256–1050 BC
MO64	CLOONAGHBOY	MAYO	RECT	Y	2.05	1	0.12	YES (3)	1253–1043 BC
RM11	CURRINAH	ROSCOMMON	RECT	Y	2.28	1.5	0.25	YES	1208–1049 BC
MO01	BOFEENAUN	MAYO	RECT	Y	0.8	1.05	0.5	YES (2)	1290–939 BC
MH41	LESHEMSTOWN	MEATH	RECT	Y	1.5	0.95	0.27	YES	1220–1000 BC
MO23	ATTIREESH	MAYO	RECT	Y	1.2	1.05	0.21	YES (13)	1187–971 BC
RM20C	BOCKAGH	ROSCOMMON	RECT	Y	2.03	1.4	0.25	YES	1115–932 BC
KK24A	ISLANDS	KILKENNY	SUB-RECT	Y	2.2	1.55	0.34	NO	1130–910 BC
KK26B	ISLANDS	KILKENNY	RECT	Y	1.7	1.4	0.24	YES	1010–830 BC
LM12B	ERREW	LEITRIM	RECT	Y	1.98	1.08	0.2	NO	1000–830 BC
MO58	FAULEENS	MAYO	SUB-RECT	Y	1.98	0.98	0.5	YES	774–521 BC
MO47	SONNAGH	MAYO	RECT	Y	2.6	1.5	0.5	YES	761–418 BC
DW01	BALLYCROGHAN	DOWN	RECT	Y	1.8	0.9	-	YES (4)	NO DATE
MO47	SONNAGH	MAYO	RECT	Y	2.2	1.26	0.26	YES	NO DATE
AM05	BALLYKENNEDY	ANTRIM	SUB-RECT	Y	1.92	0.9	0.55	NO	NO DATE
AM06	BALLYBENTRAGH	ANTRIM	SUB-RECT	Y	2.9	1.7	0.66	-	NO DATE
WD20	KNOCKHOUSE LOWER	WATERFORD	SUB-RECT	Y	3.2	2	0.6	NO	NO DATE
SO21	BALLYGLASS	SLIGO	SUB-RECT	Y	2	0.8	0.3	YES	NO DATE
KY08	GROIN	KERRY	CIRC	Y	1.67	1.56	0.65	NO	NO DATE
DN11	KNOCK	DUBLIN	SUB-CIR	Y	2.1	1.8	0.2	NO	NO DATE
TY13	KILLORAN	TIPPERARY	SUB-CIR	Y	1.25	1.25	0.25	NO	NO DATE
TY13	KILLORAN	TIPPERARY	SUB-OVAL	Y	1.82	1.18	0.42	PEGS	NO DATE
WW07	RATHMORE	WICKLOW	SUB-OVAL	Y	2.25	1.64	0.9	YES (2)	NO DATE

Figure 10.3. Possible wattle-lined troughs excavated at burnt mounds in Ireland.

Cat No	Site	County	Shape	Lining	L (m)	W (m)	Depth	Stakes	Date
KD25	Ballymount	Kildare	Sub-circ	Poss.	1.9	1.8	0.51	Yes (15)	2860–2490 BC
WM13	Newdown	Westmeath	Sub-oval	Poss.	1.8	1.2	0.5	Yes (9)	2600–2220 BC
SO17	Magheraboy	Sligo	Circ	Poss.	1.45	1.56	0.54	Yes (26)	2580–2200 BC
KD26	Ballymount	Kildare	Sub-circ	Poss.	3.9	1.9	0.85	Yes (42)	2470–2290 BC
LK33	Ballymackeamore	Limerick	Sub-oval	Poss.	1.6	1.35	0.25	Yes (14)	2461–2204 BC
KK57	Kellymount 3	Kilkenny	Rect	Poss.	2.38	1.56	0.2	Yes (22)	2399–2154 BC
LS20	Cannonswood	Laois	Circ	Poss.	2.05	1.89	0.36	Yes(10)	2330–1970 BC
CO75	Ballyadam	Cork	Sub-cir	Poss.	1.6	1.4	0.5	Yes (7)	2271–2028 BC
RM15a	Taduff East	Roscommon	Rect	Poss.	2.2	1	0.25	Yes (17)	2263–2030 BC
KY06b	Cloghers	Kerry	Oval	Poss.	2	1.85	0.47	Yes (26)	2349–1940 BC
WD04	Graigueshoneen	Waterford	Circ	Poss.	1.4	1.4	0.45	Yes (11)	2210–2010 BC
DN15	Carrickmines Great	Dublin	Circ	Poss.	0.6	0.7	-	Yes (8)	2200–2010 BC
MH13	Cloncowan	Meath	Oval	Poss.	1.7	1.7	0.74	Yes (23)	2290–1920 BC
LK17	Rathbane South	Limerick	Sub-cir	Poss.	1.45	1.25	0.4	Yes (33)	2199–1983 BC
CW17	Tomard Lower	Carlow	Sub-rect	Poss.	2.18	1.64	0.55	Yes (15)	2137–1977 BC
TY67	Greenhills	Tipperary	Sub-circ	Poss.	2.1	1.9	0.5	Yes (22)	2133–1950 BC
GY11	Barnacragh	Galway	Sub-circ	Poss.	2.39	2.2	0.38	Yes (12)	2115–1831 BC
WX05	Ask	Wexford	Oval	Poss.	2.04	1.9	0.94	Yes (13)	2025–1695 BC
WD13	Woodstown	Waterford	Sub-rect	Poss.	2.6	1.9	0.2	Yes (14)	1950–1750 BC
KK18	Rathpatrick	Kilkenny	Rect	Poss.	2.05	1.24	0.28	Yes (12)	1881–1687 BC
CO99	Killeagh	Cork	Rect	Poss.	2.2	1.45	0.6	Yes (18)	1610–1456 BC
CO28	Meenane	Cork	Sub-oval	Poss.	3.5	2.5	0.74	Yes (27)	1267–1047 BC
KY10b	Ballydowney	Kerry	Sub-oval	Poss.	2.6	1.6	0.5	Yes (9)	No Date
WD05	Graigueshoneen	Waterford	Rect	Poss.	2.46	1.68	0.54	Yes (25)	No Date
KD05b	Carton Demesne	Kildare	Sub-circ	Poss.	1.72	1.34	-	Yes (12)	No Date
KD35	Coolane	Kildare	Sub-oval	Poss.	1.7	1.32	0.35	Yes (12)	No Date
CE11	Smithstown	Clare	Oval	Poss.	2.6	1.6	0.35	Yes (16)	No Date
LK09	Cloghacloka	Limerick	Sub-rect	Poss.	1.8	1.2	0.2	Yes (9)	No Date
LK57	Tullerboy	Limerick	Sub-oval	Poss.	1.8	1.3	0.28	Yes (14)	No Date
KK57	Kellymount 3	Kilkenny	Sub-rect	Poss.	2.3	1.92	0.68	Yes (35)	No Date
LH10	Richardstown	Louth	Sub-rect	Poss.	2.4	1.4	0.5	Yes (14)	No Date

FIGURE 10.4. SURVIVING PLANK-LINED TROUGHS EXCAVATED FROM BURNT MOUNDS IN IRELAND.

CAT NO	SITE	COUNTY	SHAPE	LINING	L (M)	W (M)	DEPTH	DATE
LK03	CLOGHACLOKA	LIMERICK	SUB-REC	Y	-	-	0.03	3236–3110 BC
MH31	BALLINTER	MEATH	SUB-REC	Y	1.9	1.17	0.45	2870–2570 BC
WM05	ENNISCOFFEY	WESTMEATH	RECT	Y	1.5	1.3	0.04	2880–2490 BC
MO49	SONNAGH	MAYO	CIRC	Y	1.25	1.25	0.4	2867–2497 BC
WM12	NEWDOWN	WESTMEATH	RECT	Y	1.5	1.1	0.3	2880–2480 BC
MO27	GORTAROE	MAYO	SUB-REC	Y	1.47	1.07	0.4	2857–2495 BC
MO45A	SMUTTANAGH	MAYO	SUB-CIR	Y	1.7	1.4	0.5	2850–2480 BC
TY35	COOLDERRY	TIPPERARY	RECT	Y	1.5	1	0.16	2833–2473 BC
CO31	MUCKRIDGE	CORK	RECT	Y	2.08	3.32	1.02	2620–2280 BC
CO11	BALLYCLOGH	CORK	RECT	Y	2.3	1.3	0.4	2460–2200 BC
LK61	COONAGH WEST	LIMERICK	TRAPEZ	Y	1.2	1	0.3	2457–2203 BC
KD32	BELAN	KILDARE	SUB-OVAL	Y	1.54	1.15	0.37	2460–2150 BC
MO31	GORTAROE	MAYO	SUB-CIR	Y	1.2	1.5	0.3	2459–2147 BC
WM36	KILBEG	WESTMEATH	RECT	Y	1.5	0.9	0.2	2339–2153 BC
RM03	HUGHESTOWN	ROSCOMMON	OVAL	Y	2.1	1.3	0.3	2456–2035 BC
WM 37B	KILBEG	WESTMEATH	SUB-CIR	Y	1.5	1.5	0.15	2292–2142 BC
MH24	HARLOCKSTOWN	MEATH	OVAL	Y	1.37	0.9	0.29	2290–1970 BC
WM41B	CORREAGH	WESTMEATH	SUB-CIR	Y	1.5	1.95	0.35	2196–2029 BC
LK45	INCHAGREENOGE	LIMERICK	SUB-REC	Y	1.45	1.2	0.4	2198–1967 BC
CW03B	JOHNSTOWN	CARLOW	SUB-REC	Y	1.55	1.25	0.55	2199–1924 BC
CW03A	JOHNSTOWN	CARLOW	SUB-SQ	Y	3	3	0.21	2199–1924 BC
WW22	CHARLESLAND	WICKLOW	SUB-RECT	Y	2.26	2.05	0.97	2137–1909 BC
CE65	CLOONEEN	CLARE	SUB-CIR	Y	1.5	1.43	0.22	2132–1909 BC
KK28A	WARRENSTOWN	KILKENNY	SUB-CIR	Y	1.85	0.8	0.2	2120–1880 BC
KD12	KILMOREBRANNAGH	KILDARE	SUB-CIR	Y	1.78	1.62	0.26	2130–1760 BC
KD36	WOODLANDS EAST	KILDARE	OVAL	Y	1.8	0.7	0.16	2020–1770 BC
WW40	BALLYCLOGH NORTH A	WICKLOW	SUB-CIR	Y	1.85	1.7	0.45	2020–1770 BC
MH47	BOYERSTOWN	MEATH	RECT	Y	1.9	1	0.48	2010–1760 BC
WX10	CLOGH	WEXFORD	OVAL	Y	1.6	0.7	0.55	1940–1760 BC
WM40	KILBEG	WESTMEATH	RECT	Y	1.4	0.7	0.54	1923–1744 BC
WM41A	CORREAGH	WESTMEATH	SUB-REC	Y	2.1	1.4	0.43	1923–1744 BC
MO58	FAULEENS	MAYO	RECT	Y	1.96	0.38	0.4	1898–1746 BC
MO40	CARROWNTREILA	MAYO	OVAL	Y	2.17	3	0.85	1879–1744 BC
WW42	BALLYCLOGH NORTH	WICKLOW	RECT	Y	2.3	2.3	0.5	1920–1690 BC
MH45	COOKSLAND	MEATH	RECT	Y	2.05	1.5	0.45	1877–1613 BC
LK45B	INCHAGREENOGE	LIMERICK	SUB-REC	Y	2.2	1.28	0.4	1740–1500 BC
KY02	RATHMORE	KERRY	RECT	Y	2.41	1.02	0.21	1942–1185 BC
MO29	GORTAROE	MAYO	RECT	Y	1.8	1	0.3	1603–1433 BC
MN02	MONANNY	MONAGHAN	SUB-REC	Y	3	1.2	0.5	1900–1100 BC
CE68	GORTAFICKA	CLARE	SUB-OVAL	Y	1.62	1.26	0.09	1496–1409 BC
CE60	SRANGALLOON	CLARE	OVAL	Y	2.24	1.15	0.44	1433–1313 BC
CO04	KILLEENS	CORK	RECT	Y	1.76	1.13	0.52	1460–1240 BC
CO66	CARRIGANE	CORK	RECT	Y	2.2	1.8	0.36	1415–1219 BC

CAT NO	SITE	COUNTY	SHAPE	LINING	L (M)	W (M)	DEPTH	DATE
CE01	FAHEE SOUTH	CLARE	RECT	Y	-	-	-	1409–1212 BC
WW41	BALLYCLOGH NORTH	WICKLOW	RECT	Y	2.1	1.24	0.1	1420–1200 BC
LM07	MOHER	LEITRIM	RECT	Y	2.1	1.45	0.65	1420–1130 BC
OY06	BURROW	OFFALY	RECT	Y	2.1	1.13	0.24	1372–1129 BC
WD22	BALLYDUFF EAST	WATERFORD	SQUARE	Y	1.6	1.43	0.5	1374–1123 BC
CO09	KILCOR SOUTH	CORK	SQUARE	Y	1.41	1.45	0.5	1300–1170 BC
OY07	BURROW	OFFALY	RECT	Y	1.9	1.2	0.3	1268–1118 BC
LS30	CORRAUN	LAOIS	SUB-OVAL	Y	3.6	3	0.54	1300–1040 BC
LS29	COOLFIN	LAOIS	SUB-OVAL	Y	2.8	2.4	0.35	1300–1040 BC
CE47	CAHERAPHUCA	CLARE	RECT	Y	2.5	1.26	0.06	1299–1024 BC
WW44	BALLYCLOGH NORTH B	WICKLOW	RECT	Y	2.3	1.4	0.4	1320–1000 BC
WM53	MEARSPARKFARM	WESTMEATH	RECT	Y	2.12	1.32	0.45	1260–1019 BC
CE08	KNOCKAUN	CLARE	RECT	Y	2	1.45	0.4	1300–930 BC
MH41	LESHEMSTOWN	MEATH	RECT	Y	1.5	0.95	0.27	1220–1000 BC
MN03	MONNANY	MONAGHAN	SUB-SQ	Y	2.4	2.8	0.51	1320–890 BC
MO22	DEERPARK EAST	MAYO	RECT	Y	1.44	0.76	0.07	1261–939 BC
TY37	BALLYARD	TIPPERARY	SUB-REC	Y	1.9	1.22	0.49	1111–1064 BC
TY65A	CLOUGHJORDAN	TIPPERARY	SUB-REC	Y	2.8	1.8	0.81	1140–920 BC
CW05A	JOHNSTOWN	CARLOW	SUB-REC	Y	2.28	0.78	0.2	1115–934 BC
CW05B	JOHNSTOWN	CARLOW	SUB-REC	Y	2.04	1.41	0.2	1108–922 BC
CO48	FERMOY	CORK	RECT	Y	2	1.5	0.4	1190–800 BC
RM20A	BOCKAGH	ROSCOMMON	OVAL	Y	2.74	1.74	0.64	1041–911 BC
CE05	KILLULLA	CLARE	OVAL	Y	1.8	1.5	0.2	1120–820 BC
CO37E	CURRAHEEN	CORK	RECT	Y	1.2	0.64	0.5	1120–810 BC
WD11	GRACEDIEU WEST	WATERFORD	RECT	Y	2.7	1.6	1	1060–820 BC
KY17	KILMANIHEEN WEST	KERRY	RECT	Y	1.9	1.16	0.12	1010–830 BC
CO12	BALLYCLOGH	CORK	RECT	Y	1.5	2	0.4	1030–760 BC
WD29	GREENAN	WATERFORD	RECT	Y	2.8	2	0.6	967–820 BC
WM21	SEEOGE	WESTMEATH	SUB-CIR	Y	3.6	3.38	0.6	901–816 BC
TY47	ANNAHOLTY	TIPPERARY	SUB-REC	Y	2.75	1.98	0.56	898–808 BC
CE22	CAHIRACON	CLARE	RECT	Y	2.3	1.27	0.56	900–790 BC
CE20	CAHIRACON	CLARE	SUB-REC	Y	2.2	1.44	0.22	900–790 BC
CO50	FERMOY	CORK	SUB-REC	Y	2.5	1.6	0.37	830–780 BC
TY03	KILLORAN	TIPPERARY	RECT	Y	2	1.35	0.6	1547±9 BC
PHASE 2	CAHIRACON	CLARE	SUB-REC	Y	1.8	1.11	0.3	800–540 BC
MO59	FAULEENS	MAYO	SUB-REC	Y	2.02	1.18	0.25	786–545 BC
PHASE 2	CAHIRACON	CLARE	RECT	Y	2.3	1.27	0.56	803–525 BC
CO63	SCARTBARRY	CORK	RECT	Y	2.22	1.36	0.88	789–419 BC
WX16	MONEYCROSS UPPER	WEXFORD	RECT	Y	2.46	1.8	0.43	748–388 BC
GY03	PERSSEPARK	GALWAY	RECT	Y	3.05	1.8	0.56	998 ±9 BC
DW10	BALOO LOWER	DOWN	RECT	Y	3	1.8	0.6	993 BC
LS02	CLOONADDADORAN	LAOIS	RECT	Y	1.72	1	0.23	962 ±9 BC
CN04	DRUMBO	CAVAN	SUB-REC	Y	1.28	0.65	0.32	959 BC ±9 BC
CO60	STAGPARK	CORK	RECT	Y	2.02	1.45	0.65	2122–1828 BC
CW03B	JOHNSTOWN	CARLOW	IRREG	Y	2.3	1.7	0.5	NO DATE

Figure 10.5. Dated burnt mounds with corner posted troughs.

Cat No.	Site	County	Shape	Lining	L (M)	W (M)	Depth	Stakes	DATE
C069	Kildrum	Cork	Sub-cir	Poss.	2.9	2.2	0.6	Yes (3)	2138–1978 BC
KK56	Kellymount 3	Kilkenny	Sub-rect	Poss.	1.4	1.3	0.45	Yes (3)	2133–1940 BC
TY33	Lissava	Tipperary	Sub-oval	Poss.	2.2	1.6	0.44	Yes (4)	1685–1512 BC
WD07	Graigueshoneen	Waterford	Sub-rect	Poss.	1.54	1.4	0.6	Yes (4)	1890–1210 BC
CE64	Curtaun	Clare	Oval	Poss.	2.45	1.9	0.4	Yes(4)	1608–1459 BC
CO05	Killeens	Cork	Rect	Poss.	2.5	1.8	0.15	Yes (4)	1610–1450 BC
WM52	Mearsparkfarm	Westmeath	Sub-rect	Poss.	1.94	0.98	0.44	Yes (4)	1599–1435 BC
TY28	Raheen	Tipperary	Rect	Poss.	1.65	0.89	0.35	Yes (4)	1525–1410 BC
CE68b	Gortaficka	Clare	Oval	Poss.	2.13	1.33	0.14	Yes (4)	1496–1409 BC
TY29	Lissava	Tipperary	Rect	Poss.	1.8	1.1	0.4	Yes (3)	1411–1210 BC
OY08a	Burrow	Offaly	Rect	Poss.	2.5	1.8	0.38	Yes (4)	1408–1132 BC
LS33	Cuffsborough	Laois	Rect	Poss.	2.28	1.8	0.24	Yes (3)	1380–1110 BC
WM44	Tonaphort	Westmeath	Sub-rect	Poss.	3	1.8	0.8	Yes (4)	1370–1080 BC
LS29	Coolfin	Laois	Rect	Poss.	1.6	1.05	0.15	Yes (4)	1300–1040 BC
LS30	Corraun 2	Laois	Sub-rect	Poss.	2.05	1.35	0.2	Yes (4)	1300–1040 BC
WM08	Kilbalraherd	Westmeath	Rect	Poss.	2.3	1.4	0.18	Yes (4)	1300–1000 BC
MH52a	Boolies	Meath	Sub-rect	Poss.	1.9	1.52	0.27	Yes (5)	1266–1009 BC
CN05	Drumcalpin	Cavan	Sub-rect	Poss.	1.4	2.05	0.33	Yes (4)	1262–1007 BC
MH34	Warrenstown	Meath	Rect	Poss.	2	1.18	0.3	Yes (4)	1260–1000 BC
SO18	Magheraboy	Sligo	Sub-rect	Poss.	1.72	1.17	0.38	Yes (4)	1270–910 BC
WX16	Moneycross Upper	Wexford	Rect	Poss.	1.25	0.85	0.43	Yes (4)	1193–920 BC
LK39	Clogh East	Limerick	Sub-rect	Poss.	2.6	2	0.63	Yes (4)	1157–942 BC
WD31	Monamintra	Waterford	Rect	Poss.	1.9	1.2	0.25	Yes (4)	1124–973 BC
CO94	Coolmoohan	Cork	Sub-rect	Poss.	2.1	1.4	0.27	Yes (4)	1119–937 BC
CW10	Ballybar Lower	Carlow	Sub-rect	Poss.	2.2	2	0.43	Yes (4)	1117–935 BC
MO72	Mullenmadoge	Mayo	Sub-rect	Poss.	2.5	1.3	0.5	Yes (4)	1117–922 BC
CO103	Walshtownmore	Cork	Rect	Poss.	1.73	1.44	0.33	Yes (4)	1082–921 BC
LM07	Moher	Leitrim	Sub-rect	Poss.	1.99	1.06	0.14	Yes (4)	1120–840 BC
SO16a	Caltragh	Sligo	Rect	Poss.	2.3	1.4	0.33	Yes (4)	1000–800 BC
WM31	Cregganmacar	Westmeath	Oval	Poss.	3.5	2.25	0.5	Yes (4)	928–825 BC
KK51	Blanchvillespark	Kilkenny	Sub-cir	Poss.	2.15	1.51	0.33	Yes (4)	909–823 BC
GY23	Moyveela	Galway	Sub-rect	Poss.	2.45	1.45	0.33	Yes (3)	894–798 BC
CO96	Curragh Upper	Cork	Sub-Cir	Poss.	3.25	2.8	0.34	Yes (3)	829–787 BC
KK30	Glashare	Kilkenny	Sub-rect	Poss.	1.65	1.51	0.12	Yes (3)	830–590 BC
KK48	Knocktopher Commons	Kilkenny	Rect	Poss.	2	1	0.17	Yes (4)	776–507 BC
GY22	Moyveela	Galway	Sub-rect	Poss.	4.52	3.36	0.85	Yes (3)	731–406 BC
KD19	Burtonhall Demesne	Kildare	Rect	Poss.	2.1	1.3	0.17	Yes (5)	509–261 BC

Figure 10.6. Possible roofed structures associated with excavated burnt mounds in Ireland.

Cat No.	Site	County	Shape	L (m)	W (m)	Construction	Date
CO81	Carrignafoy	Cork	Circ	5	5	slot/Post	1433–1271 BC
CO81	Carrignafoy	Cork	Circ	4.5	3	Post	1382–1134 BC
KK19	Rathpatrick	Kilkenny	Circ	5	5	Stake	775–417 BC
KK49b	BallyKeoghan	Kilkenny	Circ	4.7	4.3	Post	1112–974 BC
OY08a	Burrow	Offaly	Circ	3.5	3.5	Stake	1200–930 BC
CW10	Ballybar Lower	Carlow	Circ	5.4	5.55	Stake	1117–935 BC
CO12	Ballyvourney	Cork	Circ	5	5	Post	No date
TY28	Raheen	Tipperary	Circ	1.5	1.5	Post	1525–1410 BC
TY34	Clonmore North	Tipperary	Circ	5.6	5.6	Post	1605–1418 BC
DW01	Ballycroghan	Down	Circ	2.1	2.1	Post	No
LK23	Prospect	Limerick	Circ	0	0	Post	No
MO40	Carrowntreilla	Mayo	Circ	6	6	Stake	1935–1687 BC
KY03	Coarhamore	Kerry	Circ			Drystone	1006–896 BC
MH21	Carranstown	Meath	Circ	8	2	Postt	No date
CN14	Bun	Cavan	Circ	6	6	Post	1192–1006 BC
SO14	Caltragh	Sligo	Circ	7.5	6.8	Post/Slot	1689–1315 BC
KY06	Cloghers	Kerry	Circ			Post	1608–1261 BC
CO07	Drombeg	Cork	Circ	5	5	Drystone	1000–800 BC
CO07	Drombeg	Cork	Circ	5	5	Drystone	1000–800 BC
MH61	Derver 4	Meath	Circ	9.3	9.3	Post	795–421 BC
DN04	Cherrywood 11	Dublin	Circ	4	4	Post	No date
DN04	Cherrywood 11	Dublin	Circ	3.5	3.5	Post	No date
CO72	Ballynamona?	Cork	Circ	5.7	5.7	Slot?	1393–1135 BC
NC	Clonee	Meath	Circ	2.7	2.7	Post	No date
MH91	Phoenixtown 2	Meath	Circ	2.25	2	Post	No date
MH26	Rath	Meath	Circ	6.2	4.8	Post	No date
TY34	Clonmore North	Tipperary	Circ	6.3	6.3	Post	1605–1418 BC
LH22	Faugaurt lower	Louth	Circ	4.9	4.5	slot	1390–1120 BC
TY24c	Richmond/ Gortladore	Tipperary	Rect	2.2	1.4	Post	2139–1949 BC
LS44	Shanboe	Laois	Rect	3.5	1.5	Stake	1600–1420 BC
CO52	Lisnagare Demesne	Cork	Rect	2	1.5	Stake	1120–820 BC
WM21	Seeoge	Westmeath	Rect	8	4	Post	901–816 BC
KK40	Rathcash	Kilkenny	Rect	4	3	Slot	1111–917 BC
WW28	Ballinaskea	Wicklow	Rect	2	2.5	Post	2210–2010 BC
LK67	Gardenhill	Limerick	Rect	2	2.5	Slot	1380–1120 BC
MO42	Skiddernagh	Mayo	Rect	2	1.5	Stake	2870–2280 BC
MH26	Rath	Meath	Rect	3	3.2	Post	370–110 BC
WD07	Craiguesheen	Waterford	Rect	4	4	Post	1890–1210 BC
DY02	Gransha	Derry	Rect	1.05	0.87	Stake	2116–1779 BC
WM42	Kilgaroan	Westmeath	Rect	3	2	Post	2023–1894 BC

Cat No.	Site	County	Shape	L (m)	W (m)	Construction	Date
MH59	Philpotstown	Meath	sub–rect	4	3	slot	1386–1123 BC
KK35	Blanchvillespark	MBA	sub–rec	-	6.5	Slot	1400–1268 BC
CO54	Scartbarry	Cork	Oval	4	4	slot	1440–1020 BC
CO94	Coolmoohan	Cork	Oval	7	2.9	Post	1190–920 BC
CO13	Ballyvourney 2	Cork	oval	2.4	2.4	Post	No
WM38	Kilbeg 6	Westmeath	Oval	3	1.9	Post	1375–1056 BC
DN02	Shankill	Dublin	Oval	3.6	2.1	Post	No date
MH87b	Cookstown	Meath	Oval	4	4	Post	No date
DN22	Lusk	Meath	Oval	3.6	2	Post	No date
MH87b	Cookstown	Meath	Oval	4	4	Post	No date
DW05	Killinure	Down	Oval	6.6	4.2	Post	No date
CO13	Ballyvourney 2	Cork	Oval	5.6	4	Post	No date
TY65a	Cloghjordan	Tipperary	Oval	6.5	5.5	slot	1190–920 BC
NC	Colp West	Clare	Oval	2.95	2.95	Post	No date
GY17	Caraun More	Galway	Oval	8	7.5	Post	1667–1393 BC
MO40	Carrowntreilla	Mayo	Oval	1.9	1.9	Stake	1935–1687 BC
KD27	Ballymount	Kildare	Oval	3.9	1.9	Stake	1130–920 BC
MO40	Carrowntreilla	Mayo	Oval	1.64	1.64	Stake	1935–1687 BC
CW15	Moanmore	Carlow	Oval	2	2	Stake	1258–1030 BC
KK46	Rathgarvin/Clifden	Kilkenny	Semi	6.5	6.5	Post	1904–1750 BC
KK34a	Baysrath	Kilkenny	sub–circ	3	0.6	slot	1887–1751 BC
MH21	Carranstown	Meath	Circ	2.6	2.1	Post	No date
LS08	Addergoole	Laois	Oval	3	1.5	Stake	2480–2280 BC
CO07	Drombeg	Cork	Circ	–	–	Post	1000–800 BC
LM02	Kildorragh	Leitrim	Circ	–	–	Post	No date
KK33b	Ballyquirk	Kilkenny	Rect	–	–	Post	1617–1494 BC
GY05	Greeneenagh	Galway	Rect	–	2	Post	1266–1016 BC

Figure 10.7. Chalcolithic radiocarbon dates from burnt stone deposits in Ireland (calibration after OxCal v. 4.2). * Numerous dates available. The 'reliability' column refers to the degree of certainty of the dated sample and its association with pyrilithic technology (see Chapter 5).

Cat. No	Site Name	County	Context dated	Date	Reliability
CN11	Kilduff	Cavan	Pit (charcoal) (Charcoal)	2458–2151 BC	B
LM05	Cloonturk*	Leitrim	Spread (charcoal)	2580–2400 BC	B
LM08	Moher	Leitrim	Spread (charcoal)	2620–2140 BC	B
LM10	Aghnahunshin*	Leitrim	Trough (charcoal) and Spread (charcoal)	2470–2200 BC	B
MO06	Ballinrobe Demesne	Mayo	Spread (charcoal)	2590–2205 BC	C
MO12	Coolroe	Mayo	Mound (Charcoal)	2571–2309 BC	B
MO20	Deerpark East	Mayo	Trough (charcoal) and deposit	2465–2205 BC	B
MO25	Attireesh	Mayo	Trough (charcoal)	2575–2351 BC	B
MO26	Attireesh	Mayo	Trough (charcoal)	2465–2299 BC	B
MO30	Gortaroe	Mayo	Trough (charcoal)	2465–2299 BC	B

Cat. No	Site Name	County	Context dated	Date	Reliability
MO31	Gortaroe	Mayo	Trough (charcoal)	2459–2147 BC	B
MO60	Fauleens	Mayo	Spread (charcoal)	2458–2286 BC	B
MO65	Cloonaghboy	Mayo	Trough (charcoal)	2568–2347 BC	B
RM03	Hughestown	Roscommon	Trough (timber)	2456–2035 BC	A
RM14	Culiaghmore*	Roscommon	Trough (charcoal)	2286–2060 BC	B
RM20a	Bockagh	Roscommon	Burnt Mound	2461–2209 BC	E
SO17	Magheraboy*	Sligo	Spread (charcoal) and Trough (charcoal)	2630–2450 BC	B
SO19b	Tonafortes	Sligo	Trough (charcoal)	2400–2140 BC	B
WD16	Killoteran	Waterford	Trough stake	2460–2140 BC	A
WX12	Coolnastudd	Wexford	Trough (charcoal)	2460–2230 BC	B
WX17	Moneycross Upper	Wexford	Pit (charcoal)	2460–2150 BC	C
LS08	Addergoole	Laois	Spread (charcoal)	2480–2280 BC	B
LS10	Aghmacart	Laois	Spread (charcoal)	2400–2140 BC	B
LS11	Ballycuddahy	Laois	Trough (charcoal)	2470–2230 BC	B
LS16b	Boherard	Laois	Trough (charcoal)	2460–2190 BC	B
LS19	Bushfield	Laois	Trough (charcoal)	2460–2130 BC	B
LS25	Clonboyne	Laois	Trough (charcoal)	2480–2280 BC	B
LS35b	Curragh*	Laois	Trough (charcoal)	2490–2290 BC	B
GY01a	Doughiska*	Galway	Mound (charcoal)	2454–2140 BC	B
GY13	Urraghry	Galway	Trough (charcoal)	2574–2348 BC	B
GY14b	Doughiska	Galway	Spread (charcoal)	2566–2342 BC	C
GY18	Killescragh*	Galway	Mound (charcoal)	2580–2015 BC	B
CE06	Killulla	Clare	Spread (charcoal)	2600–2220 BC	B
CE09	Knockaun	Clare	Spread (charcoal)	2580–2210 BC	B
CE15	Ballyleaan	Clare	Trough (charcoal)	2473–2293 BC	B
CE38	Cahircalla Beg*	Clare	Spread (charcoal)	2550–2300 BC	C
CE43	Cahircalla More	Clare	Spread (charcoal)	2470–2210 BC	B
CE43	Cahircalla More	Clare	Spread (charcoal)	2450–2150 BC	B
CE43	Cahircalla More	Clare	Spread (charcoal)	2330–2060 BC	B
CE43	Cahircalla More	Clare	Spread (charcoal)	2290–2040 BC	B
CE52	Caheraphuca	Clare	Pit (charcoal)	2465–2299 BC	C
CE54	Caheraphuca	Clare	Trough (charcoal)	2458–2143 BC	B
LK19	Crabbsland	Limerick	Mound (charcoal)	2585–2145 BC	B
LK28	Adamswood	Limerick	Trough (charcoal)	2480–2200 BC	B
LK33	Ballymackeamore	Limerick	Pit (charcoal)	2461–2204 BC	B
LK61	Coonagh West*	Limerick	Trough (timber)	2295–2064 BC	A
LK63c	Richill*	Limerick	Multiple	2457–2205 BC	B
LK64	Sallymount	Limerick	Spread (charcoal)	2470–2210 BC	B
LK65	Aughinish*	Limerick	Spread (charcoal)	2491–2292 BC	B
DN24	Ward Lower	Dublin	Trough (charcoal)	2470–2030 BC	B
WM06	Enniscoffey	Westmeath	unknown	2470–2230 BC	C
WM13	Newdown	Westmeath	Mound (charcoal)	2600–2220 BC	B
WM18	Marlinstown	Westmeath	Trough (charcoal)	2400–2140 BC	B
WM20	Kiltotan	Westmeath	Pit (charcoal)	2458–2150 BC	C

Cat. No	Site Name	County	Context dated	Date	Reliability
WM47	Ardnaglew*	Westmeath	Spread (charcoal) and Pit (charcoal)	2572–2460 BC	B
WM49a	Ballykilmore	Westmeath	Mound (charcoal)	2546–2293 BC	B
WM69	Skeahanagh*	Westmeath	Mound (charcoal)	2466–2203 BC	B
KD11	Loughlion	Kildare	Pit (charcoal)	2490–2120 BC	C
KD14	Ballynakill	Kildare	Spread (charcoal)	2460–1960 BC	C
KD17	Prumplestown*	Kildare	Multiple	2458–2137 BC	B
KD21	Mullamast*	Kildare	Trough (timber)	2550–2530 BC	A
KD22	Inchaquire*	Kildare	Trough (charcoal)	2460–2060 BC	B
KD24	Blackrath	Kildare	Spread (charcoal)	2470–2141 BC	B
KD26	Ballymount	Kildare	Post-hole (charoal)	2470–2290 BC	C
KD32	Belan*	Kildare	Trough (charcoal) and human bone	2460–2150 BC	A
CO11	Ballyclogh	Cork	Trough (timber)	2460–2200 BC	A
CO31	Muckridge	Cork	unknown	2620–2280 BC	C
CO47	Corrin*	Cork	Trough (charcoal)	2480–1970 BC	B
CO43	Ballinaspig More*	Cork	unknown	2540–2490 BC	C
CO49b	Fermoy	Cork	Trough (charcoal)	2400–2140 BC	B
CO75	Ballyadam	Cork	Spread (charcoal)	2335–2063 BC	B
CO77	Ballyadam	Cork	Pit (charcoal)	2271–2028 BC	B
CO78	Ballyadam	Cork	Trough (charcoal)	2203–1983 BC	B
CO95	Castlecooke	Cork	Trough (charcoal)	2284–2059 BC	B
CO73a	Ballinglanna North	Cork	Trough (charcoal)	2293–2140 BC	B
CO83	Ballinveiltig	Cork	Mound (charcoal)	2459–2204 BC	B
CO95	Castlecooke	Cork	Trough (charcoal)	2284–2059 BC	B
KD08	Cherryville	Kildare	Pit (charcoal)	2500–2190 BC	C
KK13	Killaspy	Kilkenny	Pit (charcoal)	2461–2211 BC	C
KK32	Ballyquirk	Kilkenny	Trough (charcoal)	2292–2143 BC	B
KK36	Danesfort	Kilkenny	Pit (charcoal)	2467–2295 BC	C
KK38	Knockadrina*	Kilkenny	Trough (charcoal)	2272–2039 BC	B
KK47	Stonecarthy West	Kilkenny	Mound (charcoal)	2398–2136 BC	B
KK49a	Ballykeoghan	Kilkenny	Trough (charcoal)	2348–2132 BC	B
KK52	Danesfort 2*	Kilkenny	Trough (charcoal)	2464–2214 BC	B
KK54	Jordanstown 3*	Kilkenny	Trough (charcoal) and Pit (charcoal)	2457–2202 BC	B
KK57	Kellymount 3*	Kilkenny	Pit (charcoal)	2399–2154 BC	C
KK58	Kellymount 6*	Kilkenny	Trough (charcoal)	2273–2038 BC	B
CW14	Moanduff 1*	Carlow	Trough (charcoal)	2464–2287 BC	B
CW15	Moanmore 3*	Carlow	Mound and Trough (charcoal)	2577–2299 BC	B
CW17	Tomard Lower*	Carlow	Trough (charcoal)	2575–2470 BC	B
TY10	Killoran	Tipperary	Trough (charcoal)	2585–2195 BC	B
TY27	Tullaheedy*	Tipperary	unknown	2619–2202 BC	C
TY36	Coolderry 2*	Tipperary	Mound and Trough (charcoal)	2429–2151 BC	B
TY37	Coolderry*	Tipperary	Trough (charcoal)	2495–2153 BC	B

Cat. No	Site Name	County	Context dated	Date	Reliability
TY42a	Gortybrigane	Tipperary	Mound (charcoal)	2290–2030 BC	B
TY43	Cooleen*	Tipperary	unknown	2263–2030 BC	C
TY57	Ballytarsna	Tipperary	Trough (timber)	2460–2140 BC	A
TY61a	Borris	Tipperary	Trough (charcoal)	2486 – 2299 BC	B
TY64a	Fennor*	Tipperary	Trough (charcoal) and Pit (charcoal)	2460 – 2130 BC	B
OY11	Culleenwaine	Offaly	Trough (charcoal)	2462–2294 BC	B
TY67	Greenhills 2*	Tipperary	Trough (charcoal) and Pit (charcoal)	2561–2299 BC	B
TY71b	Greenhills 3	Tipperary	Hearth (charcoal)	2465–2243 BC	A
MH04	Lisdornan*	Meath	Multiple	2460–2030 BC	A
MH15	Cooksland*	Meath	Pit (charcoal)	2565–2336 BC	C
MH31b	Ballinter	Meath	Mound (charcoal)	2620–2470 BC	B
MH33	Balreask*	Meath	Pit (charcoal) and Trough (charcoal)	2480–2290 BC	B
MH50	Roestown*	Meath	Trough (charcoal)	2402–2045 BC	B
MH54c	Chapelbride*	Meath	Pit (charcoal)	2465–2206 BC	B
MH63	Ardbraccan*	Meath	Multiple	2474–2210 BC	B
MH70	Williamstown	Meath	Mound (charcoal)	2465–2206 BC	B
MH71b	Williamstown	Meath	Pit (charcoal)	2402–2045 BC	C
MH73	Bennettstown	Meath	Mound (charcoal)	2461–2205 BC	B
MH76	Gainstown*	Meath	Mound and Pit (charcoal)	2566–2294 BC	B
MH77c	Kennastown	Meath	Trough (charcoal)	2468–2208 BC	B
MH77d	Kennastown	Meath	Trough (charcoal)	2402–2045 BC	B
MH78	Kennastown	Meath	Mound (charcoal)	2474–2210 BC	B
MH80	Raynestown	Meath	Pit (charcoal)	2343–2041 BC	C
MH81b	Townparks*	Meath	Multiple	2456–2059 BC	B
MH83a	Clowanstown 2	Meath	Pit (charcoal)	2576–2341 BC	B
MH83c	Clowanstown 2	Meath	Trough (charcoal)	2457–2026 BC	B
WW29	Scratenagh*	Wicklow	Hearth and Pit (charcoal)	2630–2350 BC	B
WW47	Kilmurry North	Wicklow	Trough (charcoal)	2480–2030 BC	B

Figure 10.8. Early Bronze Age radiocarbon dates from burnt stone deposits in Ireland. * Numerous dates available. The 'reliability' column refers to the degree of certainty of the dated sample and its association with pyrilithic technology (see Chapter 5).

Cat. No	Site Name	County	Context dated	Date	Reliability
CN02	Derrygarra Upper	Cavan	Mound (charcoal)	2134–1972 BC	B
CN15	Putiaghan Upper	Cavan	Spread (charcoal)	2275–2041 BC	B
CN17	Putiaghan Upper	Cavan	Spread (charcoal)	2205–2039 BC	C
KY04b	Dromthacker	Kerry	Mound (charcoal)	2140–2080 BC	B
KY15	Buntalloon	Kerry	Pit (charcoal)	1744–1524 BC	C
KY06b	Cloghers	Kerry	Trough (charcoal)	2349–1940 BC	B
KY10a	Ballydowney	Kerry	Spread (charcoal)	1892–1540 BC	B
KY22	Caherleaheen*	Kerry	Pit(charcoal)	2130–1783 BC	C
LM01	Drumsna	Leitrim	Unknown	2040–1750 BC	C
LM03	Kiltycarney	Leitrim	Unknown	1900–1720 BC	C
LM12	Errew	Leitrim	Spread (charcoal)	2200–1960 BC	B
MO03	Lecarrow	Mayo	Mound (charcoal)	2041–1892 BC	B
MO04	Lecarrow	Mayo	Mound (charcoal)	2137–1945 BC	B
MO07	Ballinrobe Demesne	Mayo	Mound (charcoal)	2198–1740 BC	B
MO14	Coolroe	Mayo	Mound (charcoal)	2021–1747 BC	B
MO16	Deerpark East	Mayo	Trough stake	1879–1691 BC	A
MO18	Deerpark East	Mayo	Trough (charcoal)	2129–1749 BC	B
MO40	Carrowntreila*	Mayo	Trough (charcoal) and Stake-Hole (charcoal)	1879–1744 BC	B
MO46	Polldrain*	Mayo	Trough (charcoal) and Pit(charcoal)	2280–1890 BC	B
MO51	Sonnagh	Mayo	Trough (charcoal)	2134–1919 BC	B
MO53	Sonnagh	Mayo	Spread (charcoal)	1725–1612 BC	B
MO58	Fauleens*	Mayo	Stake from structure	1898–1746 BC	A
MO66	Cloonfane	Mayo	Spread (charcoal)	2014–1778 BC	B
MO70	Cranmore	Mayo	Trough (charcoal)	1867–1499 BC	B
MO71	Cranmore	Mayo	Trough (charcoal)	1729–1458 BC	B
MN05	Annahagh	Monnahan	Trough (charcoal)	2290–2020 BC	B
MN06	Tullyhirm	Monnahan	Spread (charcoal)	2140–1740 BC	B
MN07	Cloghvally Upper	Monnahan	Mound (charcoal)	1830–1600 BC	B
MN02	Monanny	Monnahan	Trough timber	1900–1100 BC	A
OY05	Ardan*	Offaly	Trough (charcoal)	2141–1944 BC	B
OY08b	Burrow or Glennanummer	Offaly	Pit(charcoal)	2277–2040 BC	C
RM12	Kilbegly*	Roscommon	Trough Timbers	2134–1944 BC	A
RM15b	Taduff East*	Roscommon	Trough (charcoal)	2263–2030 BC	B
RM16	Banda	Roscommon	Trough (charcoal)	2009–1771 BC	B
RM18	Bockagh	Roscommon	Trough stake	1900–1740 BC	A
RM21	Keelbanada	Roscommon	Spread (charcoal)	2018–1774 BC	B
RM22	Keelbanada	Roscommon	Trough (charcoal)	2195–1979 BC	B
SO05a	Ballinacar	Sligo	Trough (charcoal)	1911–1729 BC	B
SO09	Caltragh	Sligo	Mound (charcoal)	2195–1861 BC	B

Cat. No	Site Name	County	Context dated	Date	Reliability
SO10	Caltragh	Sligo	Spread (charcoal)	2194–1834 BC	C
SO14	Caltragh	Sligo	Trough (charcoal)	1910–1410 BC	B
SO18	Magheraboy*	Sligo	Trough (charcoal)	2120–1890 BC	B
WD03	Ahanaglogh	Waterford	Trough (charcoal)	2300–2040 BC	B
WD04	Graigueshoneen*	Waterford	Trough (charcoal)	2210–2010 BC	B
WD06	Ahanaglogh	Waterford	Trough (charcoal)	2040–1420 BC	B
WD07	Graigueshoneen	Waterford	Trough (charcoal)	1890–1210 BC	B
WD13	Woodstown	Waterford	Trough (charcoal)	1950–1750 BC	B
WD18	Bawnfune	Waterford	Trough (charcoal)	1890–1690 BC	B
WD27	Carrickaready	Waterford	Spread (charcoal)	2127–1944 BC	B
CW03a	Johnstown*	Carlow	Pit (charcoal) and Trough (charcoal)	2199–1924 BC	B
CW08	Rathcrogue	Carlow	Pit (charcoal)	2031–1770 BC	C
WX05	Ask	Wexford	Trough (charcoal)	2025–1695 BC	B
WX07	Ballyellin*	Wexford	Stake-Hole (charcoal)	2015–1752 BC	B
WX08	Ballyellin*	Wexford	Mound (charcoal) and Pit (charcoal)	2015–1754 BC	B
WX09	Ballyloughan*	Wexford	Trough (charcoal) and Stake-Hole (charcoal)	2191–1914 BC	B
WX10	Clogh	Wexford	Trough (charcoal)	1940–1760 BC	B
WX13	Coolnastudd	Wexford	Unknown	2271–2230 BC	C
WX14	Courteencurra	Wexford	Trough (charcoal)	2290–2030 BC	B
WX18a	Parkbaun	Wexford	Mound (charcoal)	2029–1755 BC	B
WX18b	Parkbaun	Wexford	Mound (charcoal)	1901–1637 BC	B
WX21c	Raheenagurren West	Wexford	Stake-Hole (charcoal)	2150–1960 BC	B
WX22	Tinnock Lower*	Wexford	Pit (charcoal)	2016–1744 BC	C
LS07	Addergoole*	Laois	Trough (charcoal)	1960–1750 BC	B
LS14	Boherard*	Laois	Trough (charcoal)	2350–2130 BC	B
LS15b	Boherard*	Laois	Trough (charcoal)	2130–2080 BC	B
LS20	Cannonswood	Laois	Trough (charcoal)	2330–1970 BC	B
LS22a	Cappaloughlin	Laois	Trough (charcoal)	2180–2140 BC	B
LS22c	Cappaloughlin	Laois	Pit (charcoal)	1830–1620 BC	C
LS26	Clonrud	Laois	Trough (charcoal)	2280–2030 BC	B
LS31	Corraun	Laois	Spread (charcoal) and Pi t(charcoal)	2210–2010 BC	B
LS39	Leap	Laois	Spread (charcoal)	2280–2030 BC	B
LS40a	Oldglass*	Laois	Trough (charcoal)	1830–1620 BC	B
LS40b	Oldglass	Laois	Spread (charcoal)	2020–1860 BC	B
LS41a	Oldglass	Laois	Spread (charcoal)	1750–1600 BC	B
LS41b	Oldglass	Laois	Trough (charcoal)	2040–1880 BC	B
GY06	Cloonbar	Galway	Trough (charcoal)	2030–1780 BC	B
GY11	Barnacragh	Galway	Mound (charcoal)	2115–1831 BC	B
GY12	Cooltymurraghy	Galway	Mound (charcoal)	2293–2042 BC	B
GY19	Killescragh*	Galway	Mound (charcoal)	2280–926 BC	B
GY28	Caherweelder*	Galway	Mound (charcoal)	1944–1773 BC	B

CAT. NO	SITE NAME	COUNTY	CONTEXT DATED	DATE	RELIABILITY
GY29	CAHERWEELDER*	GALWAY	MOUND (CHARCOAL)	2264–1985 BC	B
GY31	BALLYGLASS WEST*	GALWAY	MOUND (CHARCOAL)	1740–1618 BC	B
CE08	KNOCKAUN*	CLARE	SPREAD (CHARCOAL)	1950–1530 BC	E
CE37	SHANNAKEA BEG	CLARE	UNKNOWN	2036–1786 BC	C
CE42	CLAREABBEY	CLARE	PIT (CHARCOAL)	2200–1960 BC	C
CE45	CAHERAPHUCA	CLARE	SPREAD (CHARCOAL)	1877–1620 BC	B
CE48	CAHERAPHUCA	CLARE	SPREAD (CHARCOAL)	2340–2149 BC	B
CE51	CAHERAPHUCA*	CLARE	SPREAD (CHARCOAL)	2287–2140 BC	B
CE53	CAHERAPHUCA	CLARE	MOUND (CHARCOAL)	2204–1974 BC	B
CE55	CAHERAPHUCA	CLARE	TROUGH (CHARCOAL)	1730–1510 BC	B
CE63	BALLYLINE*	CLARE	TROUGHS (CHARCOAL)	2129–1828 BC	B
CE64	DRUMMINACLOGHAUN	CLARE	SPREAD (CHARCOAL)	2339–2042 BC	B
CE66	CLOONEEN	CLARE	TROUGH (CHARCOAL)	2132–1909 BC	B
CE67	GORTAVOHER	CLARE	SPREAD (CHARCOAL)	2023–1887 BC	B
CE68	MONREAGH	CLARE	SPREAD (CHARCOAL)	1871–1665 BC	B
CE69	GORTAFICKA*	CLARE	PIT (CHARCOAL)	2287–2137 BC	C
LK01	RAHEEN*	LIMERICK	STAKE AND PLANK (TIMBER)	2049–1878 BC	A
LK17	RATHBANE SOUTH*	LIMERICK	TROUGH (CHARCOAL) AND MOUND (CHARCOAL)	2199–1983 BC	B
LK20	PEAFIELD	LIMERICK	TROUGH (CHARCOAL)	2030–1895 BC	B
LK30	BALLINCURRA	LIMERICK	TROUGH (CHARCOAL)	2135–1934 BC	B
LK32	BALLYMACKEAMORE	LIMERICK	TROUGH (CHARCOAL)	2200–1950 BC	B
LK43	DOLLAS UPPER	LIMERICK	MOUND (CHARCOAL)	2360–2140 BC	B
LK45	INCHAGREENOGE*	LIMERICK	TROUGH (CHARCOAL) AND STAKE	2198–1967 BC	A
LK46	INCHAGREENOGE	LIMERICK	TROUGH (CHARCOAL)	1966–1744 BC	B
LK49	KILFINNY	LIMERICK	TROUGH (CHARCOAL)	2200–1950 BC	B
DN06	NEWTOWN	DUBLIN	TROUGH (CHARCOAL)	2285–1926 BC	B
DN08	COLDWINTERS	DUBLIN	TROUGH (CHARCOAL)	1922–1618 BC	B
DN15	CARRICKMINES GREAT*	DUBLIN	TROUGH (CHARCOAL)	2200–2010 BC	B
DN16	LAUGHANSTOWN*	DUBLIN	TROUGH (CHARCOAL)	2140–1890 BC	B
WM02	BALLYNAGARBRY	WESTMEATH	UNKNOWN	1740–1510 BC	C
WM14	HEATHSTOWN	WESTMEATH	TROUGH (CHARCOAL)	2020–1770 BC	B
WM15	HEATHSTOWN	WESTMEATH	MOUND (CHARCOAL) AND TROUGH STAKE	2200–1890 BC	B
WM16	NEWTOWN	WESTMEATH	TROUGH (CHARCOAL)	1700–1520 BC	B
WM30	CREGGANMACAR	WESTMEATH	SPREAD (CHARCOAL)	2015–1886 BC	B
WM33	KILBEG	WESTMEATH	SPREAD (CHARCOAL)	1880–1690 BC	B
WM34A	KILBEG*	WESTMEATH	TROUGH (CHARCOAL)	2188–1980 BC	B
WM34B	KILBEG	WESTMEATH	TROUGH (CHARCOAL)	2136–1960 BC	B
WM35	KILBEG	WESTMEATH	SPREAD (CHARCOAL)	2339–2153 BC	B
WM36	KILBEG	WESTMEATH	MOUND (CHARCOAL)	2122–1921 BC	B
WM37B	KILBEG	WESTMEATH	MOUND (CHARCOAL) AND TROUGH STAKE	2137–1939 BC	A
WM38C	KILBEG	WESTMEATH	PIT(CHARCOAL)	2292–2142 BC	B

Cat. No	Site Name	County	Context dated	Date	Reliability
WM39	Kilbeg*	Westmeath	Trough (timber)	1923–1744 BC	A
WM40	Kilbeg	Westmeath	Trough (charcoal) and Pit (charcoal)	2196–2029 BC	B
WM41a	Correagh*	Westmeath	Pit (charcoal)	2032–1899 BC	C
WM42	Kilgaroan	Westmeath	Trough (charcoal)	2023–1894 BC	B
WM43	Kilgaroan	Westmeath	Pit (charcoal)	2134–1937 BC	E
WM44	Tonaphort*	Westmeath	Pit(charcoal)	2296–2029 BC	C
WM45	Kilbeggan South*	Westmeath	Trough (charcoal)	2200–1980 BC	B
WM48	Ballykilmore	Westmeath	Mound (charcoal)	1887–1744 BC	B
WM49b	Ballykilmore	Westmeath	Trough (charcoal)	1874–1641 BC	B
WM55	Mearsparkfarm*	Westmeath	Pit (charcoal) and Trough (charcoal)	2273–2257 BC	B
WM56	Hallsfarm*	Westmeath	Pit(charcoal)	2139–1983 BC	C
WM57	Hallsfarm*	Westmeath	Pit(charcoal)	2135–1956 BC	C
KD07	Cherryville	Kildare	Pit(charcoal)	1940–1620 BC	C
KD12	Kilmorebrannagh	Kildare	Trough (charcoal) and Stake-Hole (charcoal)	2130–1760 BC	B
KD15	Ballyburn Lower*	Kildare	Mound (charcoal) and Trough (charcoal)	1900–1700 BC	B
KD18	Ballyburn Lower*	Kildare	Trough (charcoal)	2131–1907 BC	B
KD23	Inchaquire	Kildare	Trough (charcoal)	2140–1880 BC	B
KD28	Kilgowen	Kildare	Spread (charcoal)	2210–2030 BC	B
KD29	Old Kilcullen	Kildare	Trough (charcoal)	2210–1930 BC	B
KD34	Gallowshill	Kildare	Drain	2280–1940 BC	D
KD36	Woodlands East	Kildare	Hearth and Trough (timber)	2020–1770 BC	A
CO14	Clashroe	Cork	Spread (charcoal)	1910–1730 BC	C
CO32	Maglin	Cork	Spread (charcoal)	1760–1500 BC	B
CO49c	Fermoy	Cork	Trough (charcoal)	2280–1870 BC	B
CO52	Lisnagar Demesne	Cork	Trough (charcoal)	1950–1670 BC	B
CO54	Scartbarry*	Cork	Spread (charcoal)	1940–1630 BC	B
CO59	Mitchelstown	Cork	Pit(charcoal)	1916–1696 BC	C
CO60	Mitchelstown	Cork	Stake-Hole (charcoal)	2122–1828 BC	B
CO61	Stagpark	Cork	Mound (charcoal)	2023–1773 BC	B
CO64	Fermoy*	Cork	Pit(charcoal)	2335–2036 BC	C
CO65	Carrigane	Cork	Trough (charcoal)	2139–1937 BC	B
GY39	Cloondarone	Galway	Spread (charcoal)	2127-1891 BC	B
CO69	Kildrum*	Cork	Mound (charcoal)	2138–1978 BC	B
CO75	Ballyadam	Cork	Spread (charcoal)	2335–2063 BC	B
CO76	Ballyadam*	Cork	Pit(charcoal)	2033–1770 BC	C
CO77	Ballyadam	Cork	Trough (charcoal)	2271–2028 BC	B
CO78	Ballyadam	Cork	Spread (charcoal)	2203–1983 BC	B
CO87	Ballynacorra West	Cork	Spread (charcoal)	2150–1970 BC	B
CO101	Coole Lower	Cork	Spread (charcoal)	2015–1784 BC	B
CO93	Walshtown Beg	Cork	Trough (charcoal)	1939–1772 BC	B
CO73	Ballinglanna North	Cork	Spread (charcoal)	2293–2140 BC	B

CAT. NO	SITE NAME	COUNTY	CONTEXT DATED	DATE	RELIABILITY
KK18	RATHPATRICK*	KILKENNY	TROUGH (CHARCOAL)	1931–1740 BC	B
KK24A	ISLANDS	KILKENNY	TROUGH (CHARCOAL)	2120–1880 BC	B
KK28A	WARRENSTOWN	KILKENNY	TROUGH PEG	2120–1880 BC	A
KK28B	WARRENSTOWN	KILKENNY	MOUND (CHARCOAL)	2130–1880 BC	B
KK31	BALLINVALLY	KILKENNY	PIT (CHARCOAL)	1894–1743 BC	C
KK33B	BALLYQUIRK	KILKENNY	TROUGH (CHARCOAL)	1752–1628 BC	B
KK34A	BAYSRATH	KILKENNY	POST-HOLE	1887–1751 BC	C
KK36	DANESFORT	KILKENNY	PIT (CHARCOAL)	2467–2295 BC	B
KK41B	RATHCASH	KILKENNY	TROUGH (CHARCOAL)	2024–1883 BC	B
KK42	RATHCASH EAST*	KILKENNY	TROUGH (CHARCOAL)	2281–2042 BC	B
KK45	RATHDUFF UPPER*	KILKENNY	PIT (CHARCOAL)	2134–1937 BC	C
KK46	RATHGARVIN/CLIFDEN*	KILKENNY	PIT(CHARCOAL) AND MOUND (CHARCOAL)	1927–1746 BC	B
KK47	STONECARTHY WEST *	KILKENNY	MOUND (CHARCOAL) AND TROUGH (CHARCOAL)	2398–2136 BC	B
KK48	KNOCKTOPHER COMMONS	KILKENNY	TROUGH (CHARCOAL) AND TROUGH (CHARCOAL)	1879–1690 BC	B
KK50	BLANCHVILLESPARK 4	KILKENNY	TROUGH (CHARCOAL)	1895–1753 BC	B
KK36	DANESFORT 2*	KILKENNY	TROUGH (CHARCOAL) AND WELL	2464–2214 BC	B
KK55	KELLYMOUNT 1	KILKENNY	PIT (CHARCOAL)	2140–1966 BC	C
KK58A	KELLYMOUNY 2*	KILKENNY	TROUGH (CHARCOAL)	2133–1940 BC	B
CW17	TOMARD LOWER*	KILKENNY	PIT (CHARCOAL)	2575–2470 BC	C
TY02	KILLORAN	TIPPERARY	UNKNOWN	2138–1935 BC	C
TY22	COOLAHOLLOGA	TIPPERARY	SPREAD (CHARCOAL)	2281–2044 BC	B
TY24C	RICHMOND/ GORTLANDROE	TIPPERARY	TROUGH (CHARCOAL)	2139 –1949 BC	B
TY30	LISSAVA	TIPPERARY	TROUGH (CHARCOAL)	1934 –1748 BC	B
TY43	COOLEEN*	TIPPERARY	MOUND (CHARCOAL) AND PIT (CHARCOAL)	2263 – 2030 BC	B
TY45	ANNAHOLTY	TIPPERARY	PIT (CHARCOAL)	2131–1912 BC	B
TY61	BORRIS	TIPPERARY	TROUGH (CHARCOAL)	1880–1660 BC	B
TY67	GREENHILLS 1	TIPPERARY	PIT (CHARCOAL)	2133–1950 BC	C
TY68	GREENHILLS 2	TIPPERARY	TROUGH (CHARCOAL) AND PIT (CHARCOAL)	2561–2299 BC	B
TY69	GREENHILLS 3	TIPPERARY	TROUGH (CHARCOAL)	1876–1683 BC	B
MH01	SHEEPHOUSE	MEATH	TROUGH (CHARCOAL)	2029–1777 BC	B
MH04	LISDORNAN*	MEATH	BURNT MOUND (CHARCOAL) AND TROUGH STAKE	2460–2030 BC	A
MH11	ARODSTOWN*	MEATH	TROUGH (CHARCOAL)	2290–2010 BC	B
MH12	ARODSTOWN	MEATH	TROUGH (CHARCOAL)	2280–2030 BC	B
MH13	CLONCOWAN	MEATH	TROUGH (CHARCOAL)	2290–1920 BC	B
MH14	CLONYMEATH*	MEATH	MOUND (CHARCOAL) AND TROUGH (CHARCOAL)	2285–2041 BC	B
MH23	BALTRASNA	MEATH	TROUGH (CHARCOAL)	2140–1940 BC	B
MH24	HARLOCKSTOWN*	MEATH	TROUGH (CHARCOAL)	2290–1970 BC	B

Cat. No	Site Name	County	Context dated	Date	Reliability
MH30	Carranstown	Meath	Trough (timber)	2031–1933 BC	B
MH31a	Ballinter	Meath	Mound (Charcoal)	1770–1620 BC	B
MH31c	Ballinter	Meath	Trough (charcoal)	2030–1870 BC	B
MH32	Balgeeth*	Meath	Trough (charcoal) and Spread (charcoal)	2130–1900 BC	B
MH33	Balreask*	Meath	Pit (charcoal) and Trough (charcoal)	2480–2290 BC	B
MH36	Kilmessan*	Meath	Burnt Mound (charcoal)	2030–1880 BC	B
MH37	Killeen	Meath	burnt Mound (charcoal)	2008–1767 BC	B
MH38	Athronan*	Meath	Trough (charcoal) and Pit (charcoal)	1930–1750 BC	B
MH39	Athronan	Meath	Trough (charcoal)	2120–1890 BC	B
MH41	Leshemstown	Meath	Stake-Hole (charcoal)	1880–1680 BC	B
MH42	Randalstown	Meath	Trough (charcoal)	2120–1890 BC	B
MH43	Bracetown*	Meath	Mound (charcoal)	2135–1908 BC	B
MH45	Cookstown	Meath	Pit (charcoal)	1877–1613 BC	C
MH47	Boyerstown	Meath	Pit (charcoal)	2010–1760 BC	C
MH48	Boyerstown	Meath	Mound (charcoal)	2287–2035 BC	B
MH55	Drumbaragh*	Meath	Burnt Mound (charcoal) and Trough (charcoal)	2016–1756 BC	B
MH56	Castlekeeran	Meath	Burnt Spread (charcoal)	2030–1774BC	B
MH66	Drumree	Meath	Cremation Pit (charcoal)	2130–1773 BC	D
MH67	Berrilstown	Meath	Pit (charcoal)	2285–2035 BC	B
MH68	Leshamstown	Meath	Trough (charcoal) and Pit (charcoal)	2131–1886 BC	B
MH75a	Gainstown	Meath	Pit (charcoal)	1963–1745 BC	B
MH77e	Kennastown	Meath	Trough (charcoal)	2203–1973 BC	B
MH79	Knocks	Meath	Pit (charcoal)	2293–2036 BC	C
WW28	Ballinaskea	Wicklow	Trough (charcoal)	2210 – 2010 BC	B
WW34	Cranagh	Wicklow	Trough (charcoal)	2130–1880 BC	B
WW35b	Ballynapark	Wicklow	Trough (charcoal)	1890–1680 BC	B
WW40a	Ballyclogh North	Wicklow	Trough (charcoal)	2020–1770 BC	B
WW42b	Ballyclogh North	Wicklow	Trough (timber)	1920–1690 BC	A
WW51	Coolacork*	Wicklow	Trough (timbers)	2130–1780 BC	A

Figure 10.9. Middle Bronze Age radiocarbon dates from burnt stone deposits in Ireland. * Numerous dates available. The 'reliability' column refers to the degree of certainty of the dated sample and its association with pyrilithic technology (see Chapter 5).

Cat. No	Site Name	County	Context date	Date	Reliability
CN10	Straheglin	Cavan	Well (charcoal)	1599–1425 BC	C
CE01	Fahee South	Clare	Trough (charcoal)	1409–1212 BC	B
CE04	Clonmoney North	Clare	Spread (charcoal)	1490–1200 BC	B
CE07	Killulla	Clare	Spread (charcoal)	1680–1390 BC	B
CE05	Killulla	Clare	Spread (charcoal)	1400–1030 BC	B
CE16	Ballynagard*	Clare	Trough (charcoal) and Mound (charcoal)	1518–1407 BC	B
CE23	Cahiracon	Clare	Mound (charcoal)	1520–1120 BC	B
CE24	Cahiracon	Clare	Unknown	1731–1517 BC	C
CE28	Carrowkilla	Clare	Pit (charcoal)	1690–1310 BC	C
CE29	Cragbrien	Clare	Mound (charcoal)	1372–1100 BC	
CE35	Mount	Clare	Spread (charcoal)	1631–1440 BC	C
CE55	Caheraphuca*	Clare	Trough (charcoal)	1730–1510 BC	B
CE56	Rathwilladoon	Clare	Mound (charcoal)	1601–1436 BC	B
CE59	Monreagh	Clare	Trough (charcoal)	1409–1269 BC	
CE60	Srangalloon*	Clare	Trough (charcoal)	1433–1313 BC	B
CE64b	Curtaun	Clare	Pit (charcoal)	1608–1459 BC	B
CE68	Gortaficka	Clare	Trough (charcoal)	1496–1409 BC	B
KY05	Buntalloon	Kerry	Trough (charcoal)	1744–1524 BC	B
KY10	Ballydowney	Kerry	Hearth	1490–1200 BC	A
KY13	Garraunderragh	Kerry	Mound (charcoal)	1530–1400 BC	B
KY02	Rathmore	Kerry	Trough timber	1942–1185 BC	A
LMO7	Moher a-b	Leitrim	Multiple	1610–1390 BC	B
GY01c	Doughiska	Galway	Mound (charcoal)	1516–1168 BC	B
GY08	Furzypark	Galway	Mound (charcoal)	1611–1443 BC	B
GY10	Clogharevaun	Galway	Mound (charcoal) and Trough (charcoal)	1496–1373 BC	B
GY14	Doughiska*	Galway	Mound (charcoal)	1494–1397 BC	B
GY17	Caraun More	Galway	Trough timber	1667–1393 BC	A
GY18	Killescragh	Galway	Timber Platform	1394–1132 BC	A
GY19	Killescragh*	Galway	Mound (charcoal)	1610–1410 BC	B
GY27	Caherweelder	Galway	Trough (charcoal) and Mound (charcoal)	1668–1501 BC	B
GY28	Caherweelder	Galway	Trough (charcoal)	1448–1316 BC	B
GY31	Ballyglass West*	Galway	Trough (charcoal) and Mound (charcoal)	1740–1618 BC	B
GY33	Annagh Hill	Galway	Pit (charcoal)	1367–1117 BC	C
GY34	Ardskeagh Beg	Galway	Trough (charcoal)	1878–1691 BC	B
GY35	Cloondarone A	Galway	Spread (charcoal)	1668–1519 BC	B
GY36	Cloondarone 3	Galway	Spread (charcoal)	1432–1312 BC	B
GY37	Cloondarone 4	Galway	Spread (charcoal)	1497–1321 BC	B
GY38	Cloodarone 5	Galway	Trough (charcoal)	1437–1313 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
GY43	Cloondarone 12	Galway	Trough (charcoal)	1426–1308 BC	B
LS16a	Boherard	Laois	Trough (charcoal)	1620–1440 BC	B
LS23	Clonadacasey	Laois	Trough (charcoal)	1670–1490 BC	B
LS28	Coolfin*	Laois	Well (charcoal) and linear feature	1520–1400 BC	B
LS42	Shanboe*	Laois	Trough (charcoal) and Well (charcoal)	1510–1380 BC	B
LS44	Shanboe	Laois	Trough (charcoal)	1600–1420 BC	B
LS45	Springfield	Laois	Pit (charcoal)	1690–1510 BC	C
MN04	Annahagh	Monnaghan	Trough (charcoal)	1690–1490 BC	B
MO13	Coolroe	Mayo	Trough (charcoal)	1387–1215 BC	B
MO16	Deerpark East	Mayo	Trough (charcoal)	1691–1433 BC	B
MO29	Gortaroe	Mayo	Mound (charcoal)	1603–1433 BC	B
MO23	Carrowmore	Mayo	Pit (charcoal)	1520–1390 BC	C
M48a	Sonnagh	Mayo	Trough timber	1492–1413 BC	A
M48a	Sonnagh*	Mayo	Pit (charcoal)	1413–1212 BC	C
	Sonnagh	Mayo	Trough timber	1368–1132 BC	A
MO52	Sonnagh	Mayo	Trough timber	1401–1294 BC	A
MO54	Sonnagh	Mayo	Mound (charcoal)	1528–1214 BC	B
MO56	Sonnagh	Mayo	Post	1660–1527 BC	A
	Cloonmeen West	Mayo	Trough (charcoal)	1390–1054 BC	B
OY06	Burrow or Glennanummer	Offaly	Multiple	1408–1132 BC	B
	Cranmore	Mayo	Trough (charcoal)	1729–1458 BC	B
OY04	Ardan*	Offaly	Trough (charcoal)	1634–1444 BC	B
OY07	Burrow or Glennanummer	Offaly	Trough (charcoal)	1372–1129 BC	B
RM06	Cloongownagh	Roscommon	Spread (charcoal)	1620–1310 BC	B
RM17	Bockagh*	Roscommon	Trough (charcoal)	1489–1317 BC	B
SO06	Caltragh	Sligo	Mound (charcoal)	1741–1516 BC	B
SO07	Caltragh*	Sligo	Mound (charcoal)	1737–1459 BC	B
SO14	Caltragh	Sligo	Trough (charcoal)	1910–1410 BC	B
SO15	Caltragh	Sligo	Trough (charcoal)	1630–1400 BC	B
WD02	Ahanaglogh	Waterford	Trough (charcoal)	1690–1500 BC	B
WD07	Graigueshoneen	Waterford	Trough (charcoal)	1890–1210 BC	B
WD16	Killoteran*	Waterford	Mound (charcoal)	1490–1120 BC	B
WD24	Glencove	Waterford	Trough (charcoal)	1608–1433 BC	B
WD26a	Shanakill	Waterford	Mound (charcoal)	1436–1316 BC	B
LK35	Ballynacragga*	Limerick	Multiple	1517–1413 BC	B
LK52	Leahys*	Limerick	Trough (charcoal) and hearth	1520–1390 BC	B
LK60	Coonagh West	Limerick	Spread (charcoal)	1491–1319 BC	B
LK61	Coonagh West	Limerick	linear feature (charcoal)	1604–1434 BC	D
LK62	Brackbaun	Limerick	Trough (charcoal)	1634–1454 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
LK64	Lisnagry	Limerick	Trough (charcoal) and Mound (charcoal)	1614–1463 BC	B
LK67	Gardenhill	Limerick	Trough (charcoal)	1380–1120 BC	B
LK68	Gortnalahagh	Limerick	Mound (charcoal) and Trough (charcoal)	1750–1540 BC	B
CW12	Cranavonane	Carlow	Mound (charcoal)	1386–1135 BC	B
WX02	Ballyvergin	Wexford	Pit (charcoal)	1650–1420 BC	C
WX07	Ballyellin*	Wexford	Mound (charcoal) and Pit (charcoal)	1603–1388 BC	B
WX15	Killybegs*	Wexford	Trough (charcoal) and Spread (charcoal)	1406–1060 BC	B
KK03	Bonnetstown	Kilkenny	Spread (charcoal)	1604–1438 BC	B
KK05	Grange*	Kilkenny	Trough (charcoal)	1617–1407 BC	B
KK12	Kilmurry	Kilkenny	Trough (charcoal)	1506–1410 BC	B
KK14	Ballynamona*	Kilkenny	Trough (charcoal) and channel	1634–1507 BC	B
KK16	Ballymountain	Kilkenny	Mound (charcoal)	1536–1422 BC	B
KK20	Killaspy*	Kilkenny	Trough (charcoal)	1749–1536 BC	B
KK23	Newrath	Kilkenny	Hearth	1413–1289 BC	A
KK24b	Islands	Kilkenny	Trough (charcoal)	1740–1520 BC	B
KK25	Isalnds	Kilkenny	Mound (charcoal)	1670–1490 BC	B
KK27	Isalnds*	Kilkenny	Mound (charcoal)	1610–1410 BC	B
KK29d	Foulkscourt	Kilkenny	Pit (charcoal)	1730–1510 BC	C
KK29g	Foulkscourt	Kilkenny	Pit (charcoal)	1400–1130 BC	C
KK33b	Ballyquirk	Kilkenny	Trough (charcoal)	1617–1494 BC	B
KK35	Blanchvillespark*	Kilkenny	Structure (charcoal)	1412–1269 BC	B
KK41a	Rathcash	Kilkenny	Trough (charcoal)	1727–1530 BC	B
KK43	Rathduff Upper*	Kilkenny	burnt Mound (charcoal) and Trough (charcoal)	1610–1460 BC	B
KK44	Rathduff Bayley	Kilkenny	Mound (charcoal)	1607–1455 BC	B
KK45	Rathduff Upper	Kilkenny	Pit (charcoal)	1497–1417 BC	C
CW13	Bannagagole	Carlow	Trough (charcoal)	1679–1519	B
KK56	Kellymount 2	Kilkenny	Trough (charcoal)	1679–1523BC	B
WM02	Ballynagarbry	Westmeath	Mound (charcoal)	1740–1510 BC	B
WM16	Newtown	Westmeath	Trough (charcoal)	1700–1520 BC	B
WM17	Newtown	Westmeath	Mound (charcoal)	1420–1260 BC	B
WM22	Seeoge	Westmeath	Mound (charcoal)	1616–1457 BC	B
WM24	Boyanaghcalry*	Westmeath	Mound (charcoal)	1605–1428 BC	B
WM25e	Williamstown	Westmeath	Trough (charcoal)	1605–1420 BC	B
WM31	Cregganmacar*	Westmeath	Mound (charcoal)	1431–1313 BC	B
WM33	Kilbeg	Westmeath	Pit (charcoal)	1375–1056 BC	C
WM41b	Correagh	Westmeath	Trough (charcoal) and Spread (charcoal)	1389–1213 BC	B
WM44	Tonaphort	Westmeath	Trough (charcoal) and post-hole	1499–1301 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
MH52	Mearsparkfarm*	Westmeath	Mound (charcoal) and Pit (charcoal)	1736–1531 BC	B
MH55	Mearsparkfarm	Westmeath	Trough (charcoal)	1410–1269 BC	B
WM58	Kilavally	Westmeath	Mound (charcoal)	1521–1428 BC	B
WM60	Stonehouse Farm	Westmeath	Pit (charcoal)	1630–1450 BC	C
KD09a	Cherryville	Kildare	Pit (charcoal)	1540–1370 BC	C
KD22	Inchaquire	Kildare	Trough (charcoal) and cist	1670–1430 BC	B
MH01b	Sheephouse	Meath	Trough (charcoal)	1415–1220 BC	B
MH03	Sarsfieldstown*	Meath	Trough (charcoal) and linear	1450–1110 BC	B
MH08	Rathmullan	Meath	Pit (charcoal)	1630–1400 BC	C
MH43	Bracetown	Meath	Mound (charcoal)	1387–1129 BC	B
MH54a	Chapelbride	Meath	Trough (charcoal)	1612–1433 BC	B
MH59	Philpotstown*	Meath	Multiple	1608–1417 BC	B
MH64	Ardbraccan*	Meath	Trough (charcoal) and Pit (charcoal)	1601–1392 BC	B
MH71a	Williamstown or Bawn	Meath	Well (charcoal) and Trough (charcoal)	1379–1117 BC	B
MH72	Bennettstown	Meath	Spread (charcoal)	1626–1440 BC	B
MH74	Johnstown	Meath	Well (charcoal)	1408–1132 BC	C
LH23	Faugart Lower	Louth	Hearth	1390–1120 BC	A
TY01	Derryfadda	Tipperary	Trough (charcoal)	1400–990 BC	B
TY03	Killoran	Tipperary	Trackway	1590–1570 BC	A
TY05	Killoran	Tipperary	platfrom	1425–1120 BC	A
TY08	Killoran	Tipperary	Trough (charcoal)	1750–1410 BC	B
TY28	Raheen*	Tipperary	burnt Mound (charcoal) and Trough (charcoal)	1748–1536 BC	B
TY29	Lissava	Tipperary	Trough (charcoal)	1411–1210 BC	B
TY33	Lissava	Tipperary	Trough (charcoal)	1685–1512 BC	B
TY34	Clonmore North*	Tipperary	Mound (charcoal) and structure	1525–1412	B
TY39	Gortybrigane*	Tipperary	Mound (charcoal) and Spread (charcoal)	1403–1262 BC	B
TY44	Annaholty*	Tipperary	Trough (charcoal), Mound (charcoal) and Pit (charcoal)	1496–1401 BC	B
TY45	Annaholty*	Tipperary	wooden feature	1524–1414 BC	A
TY46	Annaholty	Tipperary	Trough (charcoal)	1612–1501 BC	B
TY49a	Killalane	Tipperary	Spread (charcoal)	1501–1418 BC	B
TY66	Park 2*	Tipperary	Trough (charcoal) and Well (charcoal)	1508–1422 BC	B
TY60	Rathcunikeen	Tipperary	Trough (charcoal) and Pit (charcoal)	1729–1534 BC	B
TY62	Borris*	Tipperary	Trough (charcoal)	1740–1520 BC	B
TY54	Carrigatogher Harding site 6	Tipperary	Post	1400–1130 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
TY69	Camlin 1	Tipperary	Trough (charcoal) and Well (charcoal)	1530–1410 BC	B
CO04	Killeens	Cork	Trough timber	1460–1240 BC	A
CO05	Killeens	Cork	Trough timber	1610–1450 BC	A
CO09	Kilcor south	Cork	Trough timber	1300–1170 BC	A
CO13	Dromnea	Cork	Hearth	1440–1260 BC	A
CO14	Clashroe	Cork	Trough (charcoal)	1390–1120 BC	B
CO21	Killalough	Cork	Trough timber	1535 BC	A
CO22	Ballinvinny	Cork	Hearth	1640–1490 BC	A
CO32	Maglin	Cork	Spread (charcoal)	1760–1500 BC	B
CO30	Clashadunna	Cork	Trough (charcoal)	1410–1120 BC	B
CO49	Fermoy	Cork	Trough (charcoal)	1750–1440 BC	B
CO51	Kilbrien	Cork	Trough (charcoal)	1760–1420 BC	B
CO54	Scartbarry*	Cork	Multiple	1650–1190	B
CO55	Barrees	Cork	Mound (charcoal)	1630–1460 BC	B
CO57	Garranes*	Cork	Multiple	1681–1516 BC	B
CO66	Carrigane	Cork	Trough (charcoal)	1608–1437 BC	B
CO67	Carrigane	Cork	Mound (charcoal)	1415–1219 BC	B
CO82	Cappagh	Cork	Mound (charcoal)	1527–1427 BC	B
CO85	Castlemary	Cork	Spread (charcoal)	1500–1310 BC	B
CO86	Castlemary	Cork	Spread (charcoal)	1690–1500 BC	B
CO97	Macroney Upper	Cork	Trough (charcoal)	1734–1537	B
CO99	Killeagh	Cork	Trough (charcoal)	1610–1456	B
CO72	Ballynamona 2*	Cork	Trough (charcoal) and Mound (charcoal)	1492–1316	B
WW28	Ballinaskea*	Wicklow	Pit (charcoal)	1430–1120	C
WW30	Scratenagh	Wicklow	Spread (charcoal)	1610–1250 BC	C
WW37e	Ballynapark	Wicklow	Spread (charcoal)	1520–1390	B
WW41	Ballyclogh North	Wicklow	platfrom	1400–1050BC	A
WW43	Ballyclogh North*	Wicklow	Multiple	1420–1200	B
WW49	Ballyvaltron	Wicklow	Spread (charcoal)	1730–1440	B

Figure 10.10. Late Bronze Age radiocarbon dates from burnt stone deposits in Ireland. * Numerous dates available. The 'reliability' column refers to the degree of certainty of the dated sample and its association with pyrilithic technology (see Chapter 5).

Cat. No	Site Name	County	Context date	Date	Reliability
LSO2	Clonaddoran	Laois	Trough (timber)	961 BC	A
CN03	Drumbo 1	Cavan	Mound (charcoal)	906–814 BC	A
CN04	Drumbo 2	Cavan	Trough (timber)	959±9 BC	A
CN05	Drumcalpin	Cavan	Trough (stake)	1154–932 BC	A
CN14	Bun	Cavan	Spread (charcoal)	997–841 BC	B
CE05	Killulla	Clare	Spread (charcoal)	1120–820 BC	B
CE08	Knockaun	Clare	Trough (timber)	1300–930 BC	A
CE10	Smithstown	Clare	Spread (charcoal)	820–770 BC	B
CE11	Smithstown	Clare	Trough (charcoal)	1140–800 BC	B
CE20	Cahiracon*	Clare	Trough (timber)	1000–830 BC	A
CE22	Cahiracon*	Clare	Trough (timber)	900–790 BC	A
CE33	Lisheen	Clare	Pit (charcoal)	1020–830 BC	C
CE34	Lisheen	Clare	Mound (charcoal)	1065–910 BC	B
CE39	Killow	Clare	Spread (charcoal)	920–800 BC	B
CE47	Caheraphuca	Clare	Mound (charcoal)	1299–1024	B
CE41	Clareabbey	Clare	Spread (charcoal)	1000–820 BC	B
CE49	Caheraphuca*	Clare	Mound (charcoal)	1007–850 BC	B
CE55	Caheraphuca	Clare	Mound (charcoal)	1108–922 BC	B
CE58	Derrygarriff	Clare	Trough (charcoal)	1006–850 BC	B
CE59	Monreagh	Clare	Pit (charcoal)	975–832 BC	C
CE67b	Monreagh	Clare	Mound (charcoal)	925–802 BC	B
GY14	Doughiska*	Galway	Mound (charcoal)	1124–846 BC	B
GY14	Doughiska	Galway	Mound (charcoal)	904–802 BC	B
GY16	Caraun More	Galway	Mound (charcoal)	1120–910 BC	B
GY19	Killescragh	Galway	Trackway (timber)	1190–926 BC	C
GY23	Moyveela	Galway	Trough (charcoal)	1010–909 BC	B
GY25	Caherweelder	Galway	Trough (charcoal)	974–831 BC	B
GY28	Caherweelder*	Galway	Mound (charcoal)	1125–947 BC	B
GY26	Caherweelder	Galway	Spread (charcoal)	1192–1005	B
GY30	Roevehagh	Galway	Pit (charcoal)	976–832 BC	C
GY32a	Dunlo	Galway	Trough (charcoal)	1058–901 BC	B
KY03	Coarhamore	Kerry	Mound (charcoal)	960–930 BC	D
KY12	Farranastack	Kerry	Trough (charcoal)	1100–900 BC	B
KY14	Garraunderragh	Kerry	Trough (charcoal)	1000–790 BC	B
KY16	Kilmaniheen West	Kerry	Trough (charcoal)	1130–920 BC	B
KY17	Kilmaniheen West	Kerry	Mound (charcoal)	1010–830 BC	B
KY20	Skahanagh	Kerry	Trough (charcoal)	996–837 BC	B
LS07	Addergoole*	Laois	Trough (charcoal)	1020–830 BC	B
LS21	Cappaloughlin	Laois	Trough (charcoal)	1160–920 BC	B
LS24a	Clonadacasey*	Laois	Well (charcoal)	1010–830 BC	C
LS32	Cross	Laois	Trough (charcoal)	1000–830 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
LS33	Cuffsborough*	Laois	Well (charcoal)	1010–830 BC	C
LS34	Cuffsborough	Laois	Pit (charcoal)	1120–900 BC	C
LS43	Shanboe	Laois	Spread (charcoal)	1220–990 BC	B
LM12	Errew	Leitrim	Spread (charcoal)	1000–830 BC	C
MO01	Bofeenaun	Mayo	Trough (timber)	1290–939 BC	A
MO22	Deerpark East	Mayo	Trough (charcoal)	1261–939 BC	B
MO23	Attireesh	Mayo	Trough (charcoal)	1187–971 BC	B
MO44	Grallagh	Mayo	Mound (charcoal)	1010–830 BC	C
MO48b	Sonnagh	Mayo	Pit (charcoal)	1044–805 BC	C
MO72	Mullenmadoge	Mayo	Stake-hole (charcoal)	1117–922 BC	A
MO73	Mullenmadoge	Mayo	Stake-hole (charcoal)	1115–841 BC	A
MN03	Monanny	Monnaghan	Trough (timber)	1320–890 BC	A
OY07	Burrow	Offaly	Trough (timber)	1268–1118 BC	A
0Y08	Burrow*	Offaly	Structure (charcoal)	1200–930 BC	A
RMO9	Currinah	Roscommon	Post-hole (charcoal)	839–799 BC	A
RM11	Currinah	Roscommon	Post (timber)	1208–1049 BC	A
RM10	Currinah	Roscommon	Trough (charcoal)	1306–1005 BC	B
SO16a	Caltragh	Sligo	Trough (charcoal)	1000–800 BC	B
SO18	Magheraboy*	Sligo	Trough (charcoal)	1270–910 BC	B
WD04	Graigueshoneen*	Waterford	Trough (charcoal)	1390–820 BC	B
WD09	Scrahane	Waterford	Trough (charcoal)	1100–900 BC	B
WD11	Gracedieu West	Waterford	Trough (timber)	1020–830 BC	A
WD22	Ballyduff east	Waterford	Mound (charcoal)	1113–904 BC	B
WD31	Monamintra	Waterford	Trough (charcoal)	1124–973 BC	B
WD30	Ballymaclode	Waterford	Mound (charcoal)	1280–900 BC	B
WD26a	Shanakill	Waterford	Spread (charcoal)	1001–893 BC	C
WD28	Whitestown	Waterford	Spread (charcoal)	1055–898 BC	C
	Carrickbeg	Waterford	Trough (charcoal)	1208-930 BC	B
WD25	Seafield	Waterford	Pit (charcoal)	941–828 BC	C
WD29	Greenan	Waterford	Trough (charcoal)	967–820 BC	B
WM19	Newtown	Westmeath	Mound (charcoal)	1120–850 BC	B
RM20c	Brockagh 4	Roscommon	Trough (timber)	1115–932 BC	A
RM20a	Brockagh 4	Roscommon	Trough (timber)	1041–911 BC	A
RM23	Toobracken	Roscommon	Wood	1111–902 BC	A
WM15	Mearsparkfarm*	Westmeath	Trough (charcoal)	1018–904 BC	B
WM55	Mearsparkfarm*	Westmeath	Trough (charcoal)	973–827 BC	B
LK21	Hermitage	Limerick	Mound (charcoal)	1190–820 BC	B
LK39	Clogh east*	Limerick	Trough (charcoal)	1020–902 BC	B
LK51	Leahys	Limerick	Trough (charcoal)	1212–994 BC	B
CW05a	Johnstown	Carlow	Trough (charcoal)	1115–934 BC	B
CW05b	Johnstown	Carlow	Pit (charcoal)	1108–922 BC	C
CW06	Busherstown*	Carlow	Mound (charcoal)	1016–850 BC	B
CW10	Ballybar Lower	Carlow	Pit (charcoal)	1117–935 BC	C
KK04	Castleinch	Kilkenny	Trough (charcoal)	943–803 BC	B
KK07	Parksgrove	Kilkenny	Trough (charcoal)	1049–835 BC	B

Cat. No	Site Name	County	Context date	Date	Reliability
KK15	Dunkitt	Kilkenny	Trough (charcoal)	1010–897 BC	B
KK17	Killaspy	Kilkenny	Mound (charcoal)	1213–975 BC	B
KK19	Rathpatrick*	Kilkenny	Trough (charcoal)	1014–844 BC	B
KK21	Rathpatrick*	Kilkenny	Trough (charcoal)	997–834 BC	B
KK24a	Islands	Kilkenny	Platform (timber)	1130–910 BC	C
KK26b	Islands	Kilkenny	Trough (timber)	1010–830 BC	A
KK27	Islands*	Kilkenny	Pit (charcoal)	1060–840 BC	C
KK29c	Foulkscourt*	Kilkenny	Trough (charcoal)	970–810 BC	B
KK34b	Baysrath	Kilkenny	Pit (charcoal)	1207–979 BC	C
KK39	Maddockstown	Kilkenny	Trough (charcoal)	1189–980 BC	B
KK40	Rathcash	Kilkenny	Trough (charcoal)	1111–917 BC	B
KK49	Ballykeoghan	Kilkenny	Trough (charcoal)	930–802 BC	B
TY01	Derryfadda	Tipperary	Unknown	1400–990 BC	C
TY04	Killoran	Tipperary	Trough (charcoal)	1305–940 BC	B
TY16	Killoran	Tipperary	Trough (timber)	932 BC	A
TY15	Killoran	Tipperary	Trough (charcoal)	1145–795 BC	C
TY20	Lahesseragh	Tipperary	Pit (charcoal)	1187–911 BC	C
TY24b	Richmond	Tipperary	Spread (charcoal)	816–971 BC	B
TY25	Solsborough	Tipperary	Spread (charcoal)	972–829 BC	B
TY38	Lackenavea	Tipperary	Pit (charcoal)	1112–924 BC	C
TY37	Ballyard	Tipperary	Trough (timber)	1111–1064 BC	A
TY40	Gortybrigane	Tipperary	Mound (charcoal)	927–827 BC	B
TY45	Annaholty*	Tipperary	Trough (timber)	973–835 BC	A
TY47	Annaholty	Tipperary	Trough (charcoal)	898–808 BC	A
TY50b	Carrigatogher*	Tipperary	Trough (charcoal)	1007–848 BC	B
TY52b	Carrigatogher	Tipperary	Trough (charcoal)	1011–904 BC	B
TY58	Aughnagomaun	Tipperary	Trough (charcoal)	1052–896 BC	B
WW51	Roscath	Wicklow	Pit (charcoal)	1210–930 BC	C
CO87	Ballynacorra West	Cork	Mound (charcoal)	1220–970 B	B
CO53	Lisnagar Demesne	Cork	Trough (charcoal)	1140–920 BC	B
CO94	Coolmoohan 9.1	Cork	Structure (charcoal)	1119–937 BC	A
CO25	Propoge 1	Cork	Trough (charcoal)	1120–910 BC	B
CO75	Ballyadam	Cork	Trough (charcoal)	996–920 BC	B
CO103	Walshtownmore 31.1	Cork	Trough (charcoal)	1082–921 BC	B
CO91	Ballincarroonig	Cork	Mound (charcoal)	1120–900 BC	B
CO37	Curraheen 5	Cork	Trough (charcoal)	985–785 BC	B
CO56	Barrees	Cork	Mound (charcoal)	1120–890 BC	B
CO100	Ballard 8.1	Cork	Trough (charcoal)	1013–906 BC	B
CO48	Fermoy 1	Cork	Trough (timber)	1190–800 BC	A
CO50	Fermoy 4	Cork	Spread (charcoal)	1030–810 BC	B
CO64	Fermoy 5*	Cork	Pit (charcoal)	997–825 BC	C
CO28	Meenane 1	Cork	Trough (charcoal)	1267–1047 BC	B
CO79	Carrigtwohill	Cork	Mound (charcoal)	917–841 BC	B
CO36	Curraheen 4	Cork	Pit (charcoal)	1000–800 BC	C
CO12	Ballyclogh 2	Cork	Trough (timber)	1030–760 BC	A

Cat. No	Site Name	County	Context date	Date	Reliability
CO96	Curragh Upper 16.1	Cork	Trough (timber)	829–787 BC	A
CO07	Drombeg	Cork	Mound (charcoal)	1000–800 BC	B
DN06	Carmanhall	Dublin	Spread (charcoal)	1200–920 BC	B
DN16	Laughanstown	Dublin	Trough (charcoal)	920–810 BC	B
LH24	Newtownbalregan	Louth	Trough (charcoal)	1270–970 BC	B
MH42	Leshemstown	Meath	Trough (charcoal)	1220–1000 BC	B
TY65a	Cloghjordan*	Tipperary	Structure (charcoal)	1190–920 BC	B
WM08	Kilbalraherd	Westmeath	Spread (charcoal)	1300–1000 BC	B
WM03	Dalystown	Westmeath	Trough (charcoal)	1300–1000 BC	B
CO70	Kilshanny 3	Cork	Trough (charcoal)	926–843 BC	B
TY70	Greenhills 3	Tipperary	Trough (charcoal)	1125–943 BC	B
MH63a	Ardbraccan*	Meath	Well (charcoal)	1299–1026 BC	C
MH74	Johnstown	Meath	Well (charcoal)	997–816 BC	C
MH46	Boyerstown 2	Meath	Pit (charcoal)	1190–920 BC	C
MH77a	Kennastown	Meath	Pit (charcoal)	1110–843 BC	C
MH52a	Boolies	Meath	Trough (charcoal)	1266–1009 BC	B
KD27	Ballymount	Kildare	Trough (charcoal)	1130–920 BC	B
KD16	Ballyburn lower*	Kildare	Pit (charcoal)	1112–898 BC	C
MH09	Rossan	Meath	Trough (charcoal)	1100–790 BC	B
MO02	Glen	Mayo	Mound (charcoal)	1260–1010 BC	B
MO02	Glen	Mayo	Mound (charcoal)	1293–1053 BC	B
GY31	Ballyglass west*	Galway	Trough (charcoal)	1125–978 BC	B
KK58d	Kellymount 6	Kilkenny	Trough (charcoal)	1187–941BC	B
KK59	Kilree 1	Kilkenny	Trough (charcoal)	1262–1056 BC	B
CW15	Moanmore	Carlow	Pit (charcoal)	1256–937 BC	C
KD37b	Woodlands East	Kildare	Trough (charcoal)	1000–820 BC	B
KD38	Prumplestown Lower	Kildare	Multiple (charcoal)	905–800 BC	B
WX10	Clogh	Wexford	Trough (charcoal)	995–840 BC	B
WX16	Moneycross Upper	Wexford	Trough (timber)	1193–920 BC	A
WX18	Raheenagurren West	Wexford	Trough (charcoal)	1120–920 BC	B
TY58	Aughnagomaun/ Ashhill	Tipperary	trough stake-hole	1052–896 BC	A
WM51	Cornaher	Westmeath	Pit (charcoal)	970–843 BC	
WW33	Scratenagh	Wicklow	Mound (charcoal)	1260–1000 BC	B
WW43	Ballyclogh North	Wicklow	Trough (charcoal)	1370–1050 BC	B
WW44b	Ballyclogh North	Wicklow	trough timber	1320–1000 BC	A
WW48	Ballyvaltron	Wicklow	Trough (charcoal)	1270–1010 BC	B
GY40	Cloondarone 7	Galway	Mound (charcoal)	1007–843 BC	B
TY69	Camlin 1	Tipperary	Trough (charcoal)	1120–920 BC	B
GY03	Perssepark	Galway	Trough (timber)	998±9 BC	A
DW10	Baloo	Down	Trough (timber)	993 BC	A
FH02	Derrybrusk 2	Fermanagh	Trough (timber)	1260–1001 BC	A
FH03	Derrybrusk 1	Fermanagh	Trough (timber)	1193–931 BC	A
CO05	Killeens	Cork	Trough (timber)	970±9 BC	A
WX13	Killybegs	Wexford	Mound (charcoal)	1251–916 BC	B

Figure 10.11. List of excavated burnt mounds with artefact finds in Ireland.

Cat No.	Site	County	Finds
KY03	Coarhamore	Kerry	Bronze Age pottery and spindle whorl
KY04b	Dromthacker	Kerry	Hammerstone
KY10c	Ballydowney	Kerry	Chert axe
CN11	Straheglin	Cavan	Flint flake, amber bead and ring-pin
CN12	Kilduff	Cavan	Flint flake
CN13	Drumalure Beg	Cavan	Flint scraper
CN14	Bun	Cavan	Bronze Age pottery, flint flakes and scraper
CE05	Killulla	Clare	Whetstone
CE08	Knockaun	Clare	Whetstones and Bronze Age pottery
CE11	Smithstown	Clare	Flint
CE40	Killow	Clare	Chert and flint flakes
CE45	Caheraphuca	Clare	Lithics and coarse stone tools
CE46	Caheraphuca	Clare	Chert lithics
CE51	Caheraphuca	Clare	Chert lithics
CE54	Caheraphuca	Clare	Platform flake
CE59	Monreagh	Clare	Saddle quern and stone axe
CE60	Srangalloon	Clare	Mudstone axe
CE61	Srangalloon	Clare	Yew handle/club
CE63	Ballyline	Clare	Mudstone axe
LM03	Kiltycarney	Leitrim	Flint flake
LMO4	Tully	Leitrim	Barbed and tanged arrowhead
LM05	Cloonturk	Leitrim	Struck flint flake
LMO6	Georgia	Leitrim	Disc sraper
LM07	Moher	Leitrim	Chert debitage and rubbing stone
LM08	Moher	Leitrim	Chert and flint flakes
LM09	Aghamore	Leitrim	Barbed and tanged arrowhead and hammerstone
LM10	Aghnahunshin	Leitrim	Barbed and tanged arrowhead, scraper and axe
LM11	Clooncolry	Leitrim	Chert scrapers
MN03	Monanny	Monaghan	Flint flake
MN04	Annahagh	Monaghan	Flint blade
MN05	Annahagh	Monaghan	Chert debitage
RM05	Cloongownagh	Roscommon	Chert flake
RM14	Culiaghmore	Roscommon	Rotary quern
CW02	Ardnehue	Carlow	Flint and chert blade
CW03	Johnstown	Carlow	Bann Flake
CW05	Johnstown	Carlow	Chert borer and flint flake
CW06	Busherstown	Carlow	Flint debitage and stone axe
CW07	Tinryland	Carlow	Bronze Age pottery
CW10	Ballybar Lower	Carlow	Flint, Bronze Age pottery, wooden artefacts, leather fragment
CW10	Ballybarm Lower	Carlow	Worked bone
WD01	Clonkerdon	Waterford	Bronze Axes

Cat No.	Site	County	Finds
WD03	Ahanaglogh	Waterford	Beaker pottery
WD07	Graigueshoneen	Waterford	Beaker pottery and quern stone fragments
WD10	Scrahane	Waterford	Flint flake
WD11	Gracedieu West	Waterford	Flint flakes
WD12	Woodstown	Waterford	Flint debitage
WD20	Ballyduff East	Waterford	Saddle quern and lithic flakes
WD23	Carriganard	Waterford	Stone pounders/hammerstones
WD27	Carrickaready	Waterford	Flint flake
WD30	Ballymaclode	Waterford	Gold bracelets and stone tools
WD31	Monamintra	Waterford	Flint flakes
WX03	Strandfield	Wexford	Bronze Age pottery
WX05	Ask	Wexford	Whetstone, flint flakes, scrapers, arrowhead and beaker pottery
WX06	Ask	Wexford	Flakes and scrapers
WX07	Ballyellin	Wexford	Flint and coarse stone tools
WX08	Ballyellin	Wexford	Flint
WX09	Ballyloughan	Wexford	Bronze Age pottery
WX10	Clogh	Wexford	Bronze Age pottery
WX12	Coolnastudd	Wexford	Flint lithics
WX14	Courteencurragh	Wexford	Flint flake
WX15	Killybegs	Wexford	Flint flakes and scrapers
WX18	Parkbaun	Wexford	Flint
WX19	Raheenagurren West	Wexford	Lithics and spindle whorl
WX20	Raheenagurren West	Wexford	Burnt flake
WX21	Raheenagurren West	Wexford	Flint flakes
WX22	Tinnock Lower	Wexford	Flint flake
OY04	Ardan	Offaly	Chert and quartz flakes
OY05	Ardan	Offaly	Flint flake
OY10	Culleenwaine	Offaly	Flint flakes, blade and scraper
MO02a	Glen	Mayo	Pestle stone
MO02b	Glen	Mayo	Hammerstone
MO03	Lecarrow	Mayo	Bronze Age pottery
MO05	Rathkelly	Mayo	Barbed and tanged arrowhead and flint flake
MO10	Ballinrobe Demesne	Mayo	Grinding stones
MO11	Coolavally	Mayo	Chert debitage
MO12	Coolroe	Mayo	Chert flakes, chunks and scraper
MO13	Coolroe	Mayo	Scraper, chert flakes and core
MO14	Coolroe	Mayo	Chert flakes
MO15	Clare	Mayo	Chert core
MO20	Deerpark East	Mayo	Chert flakes
MO23	Attireesh	Mayo	Chert hollow-scraper
MO24	Attireesh	Mayo	Chert and flint blades
MO29	Gortaroe	Mayo	Hammerstone
MO32	Bekan	Mayo	Chert debtiage
MO33a	Carrowcor	Mayo	Flint scraper, stone axe and other lithics

Cat No.	Site	County	Finds
MO34	Cloonbulban	Mayo	Chert srapers and debitage
MO35	Fallakeeran	Mayo	Flint and chert debitage
MO39	Derrinumera	Mayo	Struck flint flake
MO41	Ballyglass West	Mayo	arrowhead, scraper and flint flakes
MO44	Grallagh	Mayo	Chert scraper
MO47	Sonnagh	Mayo	chert flakes
MO48	Sonnagh	Mayo	Flint scrapers
MO50	Sonnagh	Mayo	Yew rod
MO51	Sonnagh	Mayo	Chert blade
MO52	Sonnagh	Mayo	Tin and metal bead
MO58	Fauleens	Mayo	Yew artefact and flint blade
GY01	Doughiska	Galway	Stone axe
GYO4	Lissarulla	Galway	Flint scraper and flake
GYO5	Greeneenagh	Galway	Copper alloy stick pin
GY08	Furzypark	Galway	Bronze Age pottery
GY11	Barnacragh	Galway	Chert scraper and flint blade
GY13	Urraghry	Galway	Mesolithic lithics
GY17	Caraun More	Galway	Wooden paddle
GY19	Killescragh	Galway	Yew artefact and flint debitage
GY20	Ballinillaun	Galway	chert platfrom flake
GY24	Coldwood	Galway	Chert flake, and barbed and tanged arrowhead
GY28	Caherweelder	Galway	Chert end scraper, slag
GY29	Caherweelder	Galway	Meso chert scraper
GY31	Ballyglass West	Galway	Chert blade
GY32a	Dunlo	Galway	Amber bead
GY32c	Dunlo	Galway	Rubbing stone
LS15c	Boherard	Laois	Flint scraper, beaker pottery and hammerstone
LS25	Clonboyne	Laois	Hone stone
LS34	Cuffsborough	Laois	worked hazel artefact and plano-convex knife
LS35	Curragh	Laois	Flint flakes
LS36	Curragh	Laois	Flint flakes
LS42	Shanboe	Laois	chert hollow based arrowhead
LS44	Shanboe	Laois	Hammerstone
LK15	Rossbrien	Limerick	3 stone beads
LK17	Rathbane South	Limerick	chert hollow-based arrowhead
LK18	Drominycarra	Limerick	Struck flint
LK19	Crabbsland	Limerick	Early Medieval metal finds
LK24	Ballyvollane	Limerick	Beaker pottery and possible wooden shovel blade
LK30	Ballincurra	Limerick	Flint scraper
LK33	Ballymackeamore	Limerick	Flint scraper
LK39	Clogh East	Limerick	Flint flake and crutch-headed stick pin
LK45	Inchagreenoge	Limerick	Worked wood, lithics, coarse stone tools, quern and bronze age pottery
LK49	Kilfinny	Limerick	Flint scraper and flint
LK56	Tullerboy	Limerick	Scrapers

CAT NO.	SITE	COUNTY	FINDS
LK57	TULLERBOY	LIMERICK	WORKED CHERT
LK60	COONAGH WEST	LIMERICK	CHERT TOOLS
LK61	COONAGH WEST	LIMERICK	Y-SHAPED WOODEN OBJECT
LK62	BRACKBAUN	LIMERICK	POLISHED STONE AXE
LK64	RICHILL	LIMERICK	CHERT AND FLINT DEBITAGE
WM17	NEWTOWN	WESTMEATH	CHERT DEBITAGE AND CHERT BLADE
WM20	KILTOTAN AND COLLINSTOWN	WESTMEATH	FLINT FLAKES AND CHUNKS
WM21	SEEOGE	WESTMEATH	FLINT BLADES, KNIFE AND DEBITAGE
WM23	CREGGAN LOWER	WESTMEATH	WORKED CHERT
WM25	WILLIAMSTOWN	WESTMEATH	WORKED CHERT AND BLADES
WM36	KILBEG	WESTMEATH	ANTLER PICK
WM37	KILBEG	WESTMEATH	ANTLER PICK
WM42A	CORREAGH	WESTMEATH	ANTLER HAFT AND FLINT FLAKES
WM42B	CORREAGH	WESTMEATH	NEOLITHIC AXE
WM60	SKEAHANAGH	WESTMEATH	FLINT FLAKES
WM60	STONEHOUSE FARM	WESTMEATH	WORKED CHERT
DN03	KINGSTOWN	DUBLIN	FLINT FLAKE
DN04	CHERRYWOOD	DUBLIN	POTTERY, HAMMERSTONES, ARROWHEADS AND LITHICS
DN09	CARMANHALL	DUBLIN	FLINT FLAKE
DN14	MURPHYSTOWN	DUBLIN	FLINT SCRAPERS AND DEBITAGE
DN15	CARRICKMINES GREAT	DUBLIN	BRONZE AGE POTTERY AND MANY WORKED LITHICS
DN16	LAUGHANSTOWN	DUBLIN	BRONZE AGE POTTERY, SCRAPERS AND FLINT FLAKES
DN17	OLDCOURT	DUBLIN	FLINT FLAKE
DN22	LUSK	DUBLIN	FLINT DEBITAGE
DN29	TAYLORSGRANGE	DUBLIN	FLINT LITHICS, HAMMERSTONES AND BRONZE AGE POTTERY
DN30	BALLYNAKELLEY	DUBLIN	BRONZE AXE
SO07	CALTRAGH	SLIGO	CHERT DEBTIAGE
SO09	CALTRAGH	SLIGO	CHERT AND FLINT WORKED LITHICS
SO17	MAGHERABOY	SLIGO	SCRAPERS AND CHERT BLADE
SO18	MAGHERABOY	SLIGO	CHERT LITHICS
SO19A	TONAFORTES	SLIGO	FLINT FLAKE
SO19B	TONAFORTES	SLIGO	CHERT FLAKE
SO21	BALLYGLASS	SLIGO	CHERT SCRAPER
KD03	BALLYVASS	KILDARE	FLINT SCRAPERS
KD04	KILMACREDOCK UPPER	KILDARE	SADDLE QUERN
KD05A	CARTON DEMESNE	KILDARE	ARROWHEAD, POSSIBLE STONE MOULD AND FLINT FLAKES
KD05B	CARTON DEMESNE	KILDARE	PLANO-CONVEX KNIFE
KD06	CARTON DEMESNE	KILDARE	FLINT FLAKE
KD07	CHERRYVILLE	KILDARE	FLINT FLAKE AND WORKED COBBLE
KD09	CHERRYVILLE	KILDARE	NEOLITHIC AXEHEADS, ARROWHEADS AND OTHER LITHICS
KD10	CHERRYVILLE	KILDARE	LEAF-SHAPED ARROWHEAD AND NEOLITHIC POTTERY
KD11	LOUGHLION	KILDARE	FLINT DEBITAGE AND WHETSTONE
KD12	KILMOREBRANNAGH	KILDARE	STONE BEAD
KD13	KILLICKAWEENY	KILDARE	FLINT SCRAPER
KD16	BALLYBURN LOWER	KILDARE	RUBBINGS STONES, ANVIL STONE AND FLINT FLAKE

Cat No.	Site	County	Finds
KD17	Prumplestown	Kildare	Prehistoric pottery
KD20	Boleybeg	Kildare	Chert debitage
KD21	Mullamast	Kildare	Bronze Age pottery and debitage
KD22	Inchaquire	Kildare	Flint and chert lithics
KD23	Inchaquire	Kildare	Mesolithic flint borer
KD25	Ballymount	Kildare	Flint debitage
KD26	Ballymount	Kildare	Flint debitage
KD28	Kilgowen	Kildare	Flint flake
KD31	Ballynamony	Kildare	Flint debitage
KD32	Belan	Kildare	Flint flake and re-touched flake
KD33	Moone	Kildare	worked horse metatarsal and antler cut off
KD36	Woodlands East	Kildare	Worked flint flake
KD38	Prumplestown Lower	Kildare	Axe haft and bow
LH01	Dowdallshill	Louth	flint flakes
LH02	Carstown	Louth	unworked flint
LH07	Braganstown	Louth	Arrowheads, scrapers, cores and debitage
LH08	Harristown	Louth	Flint, macehead and Bronze Age pottery
LH12	Crumlin	Louth	Flint flakes
LH14	Hill of Rath	Louth	Flint flakes
LH16	Mell	Louth	Flint debitage
LH17	Newtown	Louth	Convex end scraper
LH18	Newtown	Louth	Flint debitage
LH19	Farrandreg	Louth	Flint debitage
LH20	Mell	Louth	Flint scraper and debitage
LH24	Newtownbalregan	Louth	Flint scraper and debitage
LH25	Proleek	Louth	Flint flake
LH27	Dungooly	Louth	Worked flint
KK01	Catstown	Kilkenny	Stone discs and whetstone
KK04	Castleinch	Kilkenny	Copper alloy pin
KK06	Parksgrove	Kilkenny	Iron Slag
KK07	Parksgrove	Kilkenny	Whestone
KK15	Dunkitt	Kilkenny	Stone discs
KK16	Ballymountain	Kilkenny	Flint nodules
KK18	Rathpatrick	Kilkenny	Barbed and tanged arrowheads
KK19	Rathpatrick	Kilkenny	Flint scraper and blades
KK21	Rathpatrick	Kilkenny	Flint blade
KK24a	Islands	Kilkenny	Leaf-shaped arrowhead
KK30a	Glashare	Kilkenny	Neolithic flints
KK33c	Ballyquirk	Kilkenny	Hammerstone
KK33d	Ballyquirk	Kilkenny	Rubbing stones and flint flake
KK37	Holdenstown	Kilkenny	Quern stone and spindle whorls
KK40	Rathcash	Kilkenny	Natural flint chunk
KK41	Rathcash	Kilkenny	flint blade and saddle quern
KK43	Rathduff Upper	Kilkenny	burnt flint flake
KK45	Rathduff Upper	Kilkenny	Flint flake and hone stone

Cat No.	Site	County	Finds
KK46	Rathgarvin/Clifden	Kilkenny	Rubbing stone
KK48	Knocktopher Commons	Kilkenny	Flint flake
KK49	Ballykeoghan	Kilkenny	Saddle quern and stone disc
CW13	Bannagagole	Carlow	Rubbing stones, hone stone, flint flake and re-touched flake
KK52	Danesfort 2	Kilkenny	Rubbing stones, scrapers and stick pin
KK53	Dananbeg 1	Kilkenny	Hone stones, stone discs
KK53	Dananbeg 1b	Kilkenny	polished stone axehead
KK54	Jordanstown	Kilkenny	micro disc sraper and flint debitage
KK57	Kellymount 2	Kilkenny	Chert flake and amber bead
KK57	Kellymount 3	Kilkenny	Hone stone sand saddle quern
KK58	Kellymount 6	Kilkenny	Chert flake
KK59	Kilree 1	Kilkenny	Saddle quern
CW14	Moanduff	Carlow	Chert arrowhead and flake
CO02	Ballyvourney	Cork	Stone disc, pounder and spindle whorl
CO04	Killeens	Cork	Gold ring
CO07	Drombeg	Cork	Stone disc, perforated stone and saddle quern
CO14	Clasroe	Cork	Flint flakes
CO18	Butlerstown Little	Cork	Saddle quern
CO26	Teadies Upper	Cork	Lignite bracelet
CO28	Meenane	Cork	Flint flake and hammerstone
CO30	Clashduanna East	Cork	Flint debitage
CO36	Curaheen 4	Cork	Disc-headed pin
CO43	Ballinaspig More	Cork	Whetstone
CO46	Corrin	Cork	Flint scraper
CO47	Corrin	Cork	Flint debitage and arrow tip
CO49b	Fermoy	Cork	Flint hoard
CO51	Kilbrien	Cork	Flint debitage
CO57	Garranes	Cork	Thumbnail scraper and hammerstone
CO59	Stagpark	Cork	Prehistoric pottery
CO61	Stagpark	Cork	Flint flakes
CO70	Ballinglanna	Cork	Flint flake
CO96	Curragh Upper	Cork	Whetstone
CO79	Carrigtohill	Cork	Lignite bracelet and flint flake
TY01	Derryfadda	Tipperary	Saddle quern
TY07	Killoran	Tipperary	Tumbnail scraper
TY19	Knockaunkennedy	Tipperary	Chert flakes
TY23	Richmond	Tipperary	Flint debitage and stone axe
TY24	Richmond/Gortlandroe	Tipperary	Spindle whorl
TY27	Tullaheedy	Tipperary	Chert fragments
TY34	Clonmore North	Tipperary	Hollow-based arrowhead and Bronze age pottery
TY44a	Annaholty	Tipperary	Hammerstone
TY50a	Killalane	Tipperary	Flint flake
TY53	Carrigatogher Harding	Tipperary	Spindle whorl
TY57	Ballytarsna	Tipperary	Flint blade

Cat No.	Site	County	Finds
TY60	Rathcunikeen	Tipperary	Chert flake
TY52	Carrigatoher Harding site 6	Tipperary	Possible metal Slag
TY55	Ballywilliam	Tipperary	Flint chunks
OY11	Culleenwaine	Offaly	End scraper and blade
TY67	Greenhills 1	Tipperary	End scraper
TY70	Greehills 2	Tipperary	Chert debitage and rubbing stone
TY71	Greenhills 3	Tipperary	Chert flakes and core
TY69	Camlin 1b	Tipperary	Chert core, bronze palstave axehead and arrowhead
MH01a	Sheephouse farm	Meath	Flint scraper
MH01b	Sheephouse farm	Meath	Stone axe fragment
MH02	Gormanstown	Meath	Flint debitage and hammerstone
MH04	Lisdornan	Meath	Prehistoric pottery
MH06	Claristown	Meath	Pestle and morter
MH09	Rossan	Meath	Flint and chert
MH14	Clonymeath	Meath	Flint blade
MH15	Cooksland	Meath	Flint flake
MH16	Knockmark	Meath	Flint knife
MH20	Athboy Road	Meath	Leaf-shaped arrowhead
MH23	Baltrasna	Meath	Flint debitage
MH24	Harlockstown	Meath	Flint scraper
MH29	Rathmullen	Meath	Worked flint
MH30	Carranstown	Meath	Stone lithics
MH38	Athronan	Meath	Cores, blades and flakes
MH41	Leshemstown	Meath	Flint scraper
MH42	Randalstown	Meath	Middle Bronze Age spearhead
MH43	Bracetown	Meath	Chert blade, core and scraper. Polished bone
MH45	Cooksland	Meath	Flint debitage and end scraper
MH50	Roestown	Meath	Multiple worked lithic finds
MH51	Blundelstown	Meath	Debitage and scrapers
MH59	Philpotstown	Meath	Blade, scraper, flake and loom weight
MH63a	Ardbraccan	Meath	Hone stone
MH64	Ardbraccan	Meath	Debitage
MH65	Ardbraccan	Meath	chert blade
MH66	Drumree	Meath	Flint flakes
MH67	Berrilstown	Meath	flint flakes, retouched artefact and quartz crystal
MH68	Leshamstown	Meath	Flint debitage
MH71a	Williamstown or Bawn	Meath	Whetstone and flint debitage
MH72	Bennettstown	Meath	Flint scraper, cores and flakes
MH74	Johnstown	Meath	Flint core, blade and flake
MH75b	Gainstown	Meath	Scraper
MH76	Gainstown	Meath	Struck flint
MH77	Kennastown	Meath	Plano-convex knife
MH79	Knocks	Meath	Flint flake debitage, arrowhead, scrapers, flint knives and cores

Cat No.	Site	County	Finds
MH80	Raynestown	Meath	Flint flake
MH81	Townparks	Meath	Medieval ring-brooch
MH82	Clowanstown	Meath	Neolithic pottery, wooden artects and lithics
MH83	Clowanstown	Meath	Stone tools
WW02	Kilnacarrig	Wicklow	Flint debitage
WW06	Ballynamuddagh	Wicklow	Flint flakes
WW10	Barnacoyle big	Wicklow	Bronze Age pottery
WW16	Tiglin	Wicklow	Flint sraper
WW17	Ballyhenry	Wicklow	Multiple worked lithic finds
WW25	Ballynattin	Wicklow	Flint flake
WW05	Johnstown North	Wicklow	Multiple worked lithic finds
WW07	Rathmore	Wicklow	Gold ring
WW15	Kilmartin	Wicklow	Bronze Age pottery
WW22	Charlesland	Wicklow	Musical pipes
WW23	Charlesland	Wicklow	Saddle quern
WW27	Rampere	Wicklow	Struck flint
WW28	Ballinaskea	Wicklow	flint scraper, flint awl, flint flake and possible grinding stone
WW29	Scratenagh	Wicklow	Natural chunk and 2 waste flakes
WW31	Scratenagh	Wicklow	Flint core, natural chunk
WW32	Scratenagh	Wicklow	Flint flakes
WW34	Cranagh	Wicklow	Natural chunk, flint flake
WW35	Ballynapark	Wicklow	Lithic finds and bronze axe fragment
WW35	Ballynapark	Wicklow	Flint flakes
WW36	Ballynapark	Wicklow	Flint flakes
WW38	Cloghoge	Wicklow	Flint flakes
WW39	Ballycloge South	Wicklow	Flint flakes
WW40	BallyclogeNorth	Wicklow	2 flint blades and cores
WW41	Ballycloge North	Wicklow	Multiple worked lithic finds
WW42	Ballycloge North	Wicklow	flint flakes
WW43	Ballycloge North	Wicklow	flint flakes, scraper, core, blade
WW44	Ballycloge North	Wicklow	Lithic tools and beaker pottery
WW46	Kilmurry South	Wicklow	flint convex end scraper
WW47	Kilmurry North	Wicklow	212 waste flakes
WW49	Ballyvaltron	Wicklow	flint flakes and scraper
WW50	Coolacork	Wicklow	Flint debitage and Bronze Age pottery

Appendix 2

List of excavated burnt mounds in Ireland 1950–2010

The following is a listing of excavated burnt mounds in Ireland (by county) from the period 1950–2010, with essential information on each site type.

A more detailed summary of the excavation record of each burnt mound investigated during this period can be accessed at https://cora.ucc.ie/handle/10468/1953. It representes the authors PhD catalogue.

Terminology and abbreviations used

Meso= Mesolithic
Neo= Neolithic
Chal=Chalcolithic
EBA= Early Bronze Age
MBA=Middle Bronze Age
LBA= Late Bronze Age
IA= Iron Age
EM= Early Medieval
MED= Later/High Medieval
*Multi-period within the Bronze Age, i.e. dating to both the early and late periods
AB= Animal bone

Cat Nunber= Unique numbering system given to each site throughout the book.
NA= Information not available

Licence No= Numbering system given by licensing authority of the National Monuments Service to all archaeological excavations in the republic of Ireland. The catalogue uses a number of different licence numbers: the regular ones, which begin with the year the licence was first issued (98E114), which constitute the majority, the 'Ministerial Direction' licences, which refer mainly to road schemes (AE/00/52) (project number and site number). These are usually complemented by 'E' numbers (E2345) which refer to the 'Ministerial Consent'.

Barony, Parish, Townland= These terms refer to land divisions in Ireland. The barony is the largest land division in a county, which is formed from a number of parishes. These parishes are in turn made up of several townlands, which are the smallest land division in the country.

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
AM01	Antrim	Ballylumford	Unknown	Yes	No	No	Yes	Spread	No	Yes	EBA
AM02	Antrim	Middle Division	Unknown	Yes	No	No	No	Mound	No	No	
AM03	Antrim	Lissue	AE/00/52	No	No	No	Yes	Spread	No	No	
AM04	Antrim	Toome	AE/02/059	Poss.	No	No	Mult	No	No	Yes	EBA-MBA
AM05	Antrim	Ballykennedy	AE/06/156	Yes	No	No	Yes	Mound	No	No	
AM06	Antrim	Ballypitmave	AE/06/162	Yes	No	No	No	Spread	No	No	
AM07	Antrim	Ballyalbanagh	AE/06/168	Yes	No	No	No	Spread	No	No	
AM08	Antrim	Creevamoy	AE/03/140	No	No	No	No	Spread	No	No	
AM09	Antrim	Kinnegalliagh	AE/04/3	Poss.	No	No	Yes	Spread	No	No	
AM10	Antrim	Moore Lodge	AE/03/140	No	No	No	No	Mound	No	No	
AM11	Antrim	Vow	AE/03/140	Poss.	No	No	Yes	No	No	Yes	
AH01	Armagh	Clarkill	AE/06/102	Yes	No	No	No	Mound	Stake-holes	No	
AH02	Armagh	Lisdrumliska	AE/07/172	Mult	No	No	No	Spread	Stake-holes	No	
CW01	Carlow	Askea	04E1436	Poss.	Poss.	No	No	Spread	Platform?	No	
CW02	Carlow	Ardnehue	E2574	Yes	No	No	Mult	Spread	No	Yes	
CW03a	Carlow	Johnstown	E2575	Mult	No	No	Mult	Mound	Trough and water system	Yes	EBA
CW03b	Carlow	Johnstown	E2575	Yes	No	No	Yes	Mound	No	No	
CW04	Carlow	Johnstown	E2576	Yes	No	No	Mult	Spread	No	No	
CW05a	Carlow	Johnstown	E2586	Yes	No	No	Yes	Spread	No	Yes	MBA–LBA
CW05b	Carlow	Johnstown	E2586	Yes	No	No	Yes	Spread	No	No	MBA–LBA
CW06	Carlow	Busherstown	E2584	Yes	Poss.	Poss.	Mult	Mound	Well and timber platform	Yes	LBA–IA
CW07	Carlow	Tinryland	E2599	Yes	No	No	Mult	Mound	Platform	Yes	
CW08	Carlow	Rathcrogue	E2592	Poss.	No	No	Mult	Spread	Well	Yes	
CW09	Carlow	Clonmelsh	E2609	No	No	No	No	Spread	No	No	
CW10	Carlow	Ballybar Lower	E2618	Yes	No	Poss.	Mult	Mound	Water-channel system	Yes	MBA–LBA
CW11	Carlow	Ballybar Lower	E2618	Yes	No	Poss.	Mult	Spread	Stake-holes	Yes	
CW12	Carlow	Cranavonane	E3842	Yes	No	No	No	Mound	No	No	MBA
CW13	Carlow	Bannagagole	E3844	Mult	No	No	Mult	Mound	Post-holes and water cisterns	Yes	MBA
CW14	Carlow	Moanduff	E3839	Mult	Yes	Poss.	Mult	Mound	Iron Age Palisade	Yes	CL–MBA
CW15	Carlow	Moanmore	E3835	Yes	No	Poss.	Yes	Mound	Stake-holes	No	LBA
CW16	Carlow	Moanmore	E3837	Yes	No	No	No	Spread	No	No	CL
CW17	Carlow	Tomard Lower	E3733	Yes	No	No	Yes	Spread	Water-channel	No	EBA
CN01	Cavan	Cloughballybeg	Unknown	Yes	No	No	No	Spread	No	No	
CN02	Cavan	Derrygarra Upper	98E164	No	Poss.	No	Mult	Mound	Stone setting	No	EBA
CN03	Cavan	Drumbo	98E164	No	No	No	No	Spread	No	No	LBA
CN04	Cavan	Drumbo	98E164	Yes	Yes	No	No	Spread	No	No	LBA
CN05	Cavan	Drumcalpin	98E164	Yes	No	No	No	Mound	No	No	LBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
CN06	Cavan	Drummany	98E164	Yes	No	No	No	Mound	No	No	
CN07	Cavan	Cootehill	99E644	Yes	No	No	No	Mound	Poss. clay platform	No	
CN08	Cavan	Pollamore Near	04E1171	Poss.	No	No	No	Mound	No	Yes	
CN09	Cavan	Cornaghleragh	04E1172	Yes	Yes	No	Yes	Mound	Poss. windbreak	Yes	
CN10	Cavan	Straheglin	E3829	Yes	No	No	Mult	Spread	Well	Yes	MBA
CN11	Cavan	Kilduff	E3812	Yes	No	No	No	Spread	No	Yes	EBA
CN12	Cavan	Drumalure Beg	E3817	Yes	No	No	Mult	Spread	No	Yes	
CN13	Cavan	Drumalure Beg	E3813	Poss.	No	No	Mult	No	No	No	
CN14	Cavan	Bun	E3816	No	No	Yes	No	Mound	Post-holes	Yes	LBA
CN15	Cavan	Putiaghan Upper	E3821	Yes	No	No	Yes	Spread	Well	No	EBA
CN16	Cavan	Putiaghan Upper	E3822	No	No	No	Yes	Spread	Waste pit	Yes	LIA–EM
CN17	Cavan	Putiaghan Upper	E3824	No	No	No	Yes	Spread	Poss. platform	No	EBA
CE01	Clare	Fahee South	E0222	Yes	Yes	No	Yes	Mound	revetment	Yes	MBA
CE02	Clare	Ballymaley	98E0400	Yes	Yes	Poss.	Yes	Destroyed	No	No	
CE03	Clare	Corrovorrin	98E0400	No	No	No	No	No details	No	Yes	
CE04	Clare	Clonmoney North	01E0668	Yes	No	No	Yes	Spread	No	No	MBA
CE05	Clare	Killulla	01E0342	Yes	No	No	Yes	Mound	Platform	Yes	LBA
CE06	Clare	Killulla	01E0580	No	No	No	No	Spread	No	No	EBA
CE07	Clare	Killulla	01E0582	Yes	No	No	No	Mound	No	No	MBA
CE08	Clare	Knockaun	01E0689	Yes	No	No	Yes	Spreads	Gully	Yes	MBA–LBA
CE09	Clare	Knockaun	01E0521	Yes	No	No	No	Spread	No	No	EBA
CE10	Clare	Smithstown	01E0523	Yes	No	No	No	Spread	No	No	LBA
CE11	Clare	Smithstown	01E0522	Yes	No	No	Yes	Spreads	No	Yes	LBA
CE12	Clare	Ballycorick	02E1186	Yes	No	No	Yes	Mound	Well	Yes	
CE13	Clare	Ballycorick	02E1186	Yes	No	No	No	Mound	Stone surface	No	
CE14	Clare	Ballyleaan	02E1207	No	No	No	No	Mound	No	No	
CE15	Clare	Ballyleaan	02E1207	Yes	No	No	Yes	Spread	No	No	CL
CE16	Clare	Ballynagard	02E0951	Yes	No	No	No	Mound	Stake-holes	No	MBA
CE17	Clare	Bearnafunshin	02E0342	Yes	No	No	No	Mound	No	No	
CE18	Clare	Bearnafunshin	02E1824	No	No	No	No	Mound	No	No	
CE19	Clare	Cahernalough	02E1477	Yes	No	No	No	Spread	No	No	
CE20	Clare	Cahiracon	02E1137	Yes	Yes	No	No	Mound	Platform and Water-channels	No	LBA
CE21	Clare	Cahiracon	02E1138	Yes	Yes	No	Yes	Mound	Stone stockpile	No	
CE22	Clare	Cahiracon	02E0952	Yes	Yes	No	No	Mound	No	Yes	LBA
CE23	Clare	Cahiracon	02E0952	Yes	No	No	No	Mound	No	No	MBA
CE24	Clare	Cahiracon	02E1151	No	No	No	Yes	Spread	No	Yes	EBA–MBA
CE25	Clare	Cappagh Beg	02E1469	No	No	No	Yes	Spread	Stake-holes	No	
CE26	Clare	Cappagh Beg	02E1514	No	No	No	Yes	No details	Gully	No	
CE27	Clare	Carrahil	02E1341	Yes	No	No	Yes	No	No	No	
CE28	Clare	Carrowkilla	02E1028	Yes	No	No	Yes	No	Gully	No	EBA/LBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
CE29	Clare	Cragbrien	02E1352	No	No	No	No	Mound	No	No	MBA–LBA
CE30	Clare	Cragbrien	02E1299	No	No	No	Yes	Mound	Cremation pit	No	IA
CE31	Clare	Liscormick	02E1114	Yes	No	No	No	Mound	No	No	
CE32	Clare	Liscormick	02E1208	Yes	Yes (2)	No	Yes	Mounds	No	No	EBA–MBA
CE33	Clare	Lisheen	02E1226	Yes	No	No	Yes	Mound	No	No	LBA
CE34	Clare	Lisheen	02E1009	Yes	No	No	No	Mounds	No	No	LBA
CE35	Clare	Mount	02E1206	No	No	No	No	Spread	No	No	MBA
CE36	Clare	Shannakea Beg	02E0087	Yes	No	No	No	Spread	Gully	No	IA
CE37	Clare	Shannakea Beg	02E1136	Yes	No	No	Yes	Mound	No	No	EBA
CE38	Clare	Cahircalla Beg	04E0024	Yes	No	No	No	Mound	revetment	No	EBA–LBA
CE39	Clare	Killow	04E0190	No	No	No	Yes	Spread	No	No	LBA
CE40	Clare	Killow	04E0191	No	No	No	Mult	Spread	Cremation pits	Yes	LBA
CE41	Clare	Clareabbey	04E0031	No	No	No	No	Spread	No	No	LBA
CE42	Clare	Clareabbey	04E0022	Poss.	No	No	Yes	Spread	No	No	EBA
CE43	Clare	Cahircalla More	04E0028	No	No	No		Spreads	No	No	EBA–LBA
CE44	Clare	Keelty	04E0030	No	No	No	No	Spread	19th-century refuse waste	No	
CE45	Clare	Caheraphuca	E3654	Mult	No	No	Mult	Spread	Water cisterns	Yes	EBA–LBA
CE46	Clare	Caheraphuca	E3653	No	No	No	No	Spread	No	Yes	
CE47	Clare	Caheraphuca	E3653	Yes	No	No	No	Mound	No	No	LBA
CE48	Clare	Caheraphuca	E3653	No	No	No	No	Spread	No	No	EBA
CE49	Clare	Caheraphuca	E3653	Yes	No	No	No	Mound	Stone surface	No	LBA
CE50	Clare	Caheraphuca	E3653	Yes	No	No	Yes	Mound	No	Yes	LBA
CE51	Clare	Caheraphuca	E3653	No	No	Yes	Yes	Spread	Timber platforms	Yes	EBA
CE52	Clare	Caheraphuca	E3653	Yes	No	No	No	No	No	No	EBA
CE53	Clare	Caheraphuca	E3653	No	No	No	No	Mound	Stockpile	No	EBA
CE54	Clare	Caheraphuca	E3653	Yes	No	No	No	Spread	No	Yes	EBA
CE55	Clare	Caheraphuca	E3653	Yes	No	No	No	Mound	No	No	EBA–LBA
CE56	Clare	Rathwilladoon	E3655	No	No	No	No	Mound	Drain?	No	MBA
CE57	Clare	Derrygarriff	E3710	No	No	No	Yes	Spread	No	No	Med
CE58	Clare	Derrygarriff	E3716	Yes	No	No	Yes	Mound	Gully	No	LBA
CE59	Clare	Monreagh	E3712	Mult	No	No	Yes	Mound	Well/cistern	Yes	MBA–LBA
CE60	Clare	Srangalloon	E3713	Yes	No	No	No	Mound	platform	Yes	MBA–LBA
CE61	Clare	Srangalloon	E3713	Yes	No	No	Yes	Mound	Platform/well	Yes	LMA–IA
CE62a	Clare	Ballyline	E3717	Mult	No	No	Yes	Spread	No	Yes	EBA
CE62b	Clare	Ballyline	E3718	Mult	No	No	Yes	Spread	No	No	EBA
CE63	Clare	Drumminacloghaun	E3720	Yes	No	No	No	Spread	No	No	EBA-LBA
CE64a	Clare	Curtaun	E3721	Yes	No	No	No	Spread	No	No	
CE64b	Clare	Curtaun	E3722	Yes	No	No	Yes	Spread	Well	No	MBA
CE65	Clare	Clooneen	E3722	Yes	Yes	No	Yes	Mound	No	No	EBA
CE66	Clare	Gortavoher	E3984	No	No	No	No	Spread	No	No	EBA
CE67a	Clare	Monreagh	E4037	No	No	No	No	Mound	No	Yes	EBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
CE67b	Clare	Monreagh	E4038	Yes	No	No	No	Spread	No	No	LBA
CE68a	Clare	Gortaficka	E3898	No	No	No	No	Spread	No	No	
CE68b	Clare	Gortaficka	E3899	Mult	No	No	Yes	Spread	Water-channel	No	EBA–MBA
CO01	Cork	Kilnaglery	Unknown	Yes	Yes	No	No	Mound	No	No	
CO02	Cork	Gortnatubbrid (Ballyvourney I)	Unknown	Yes	Yes	Yes	No	Mound	Roasting oven	Yes	
CO03	Cork	Shanacloon (Ballyvourney II)	Unknown	Yes	Yes	Yes	No	Mound	No	No	
CO04	Cork	Killeens	Unknown	Yes	No	No	No	Mound	Kneeler	Yes	MBA
CO05	Cork	Killeens	Unknown	Yes	Yes	No	No	Mound	No	No	MBA
CO06	Cork	Killeens	Unknown	Yes	No	No	No	Mound	No	No	
CO07	Cork	Drombeg	Unknown	Yes	Yes	Yes	No	Mound	Well and drain	Yes	LBA
CO08	Cork	Mashanaglass	Unknown	Yes	Yes	No	No	Mound	No	No	
CO09	Cork	Kilcor South	Unknown	Yes	Yes	No	Yes	Mound	No	No	MBA
CO10	Cork	Castleredmond	Unknown	Yes	No	No	Yes	Spread	Stake-Holes	No	
CO11	Cork	Ballyclogh	Unknown	Yes	No	No	No	Mound	Stake-Holes	No	CL
CO12	Cork	Ballyclogh	Unknown	Yes	No	No	No	Mound	Stake-Holes	No	LBA
CO13	Cork	Dromnea	Unknown	Yes	Yes	No	No	Mound	Revetment and stone paving	No	MBA
CO14	Cork	Clashroe	Unknown	Yes	Yes	No	No	Mound	Stake-Holes	Yes	EBA
CO15	Cork	Castleview	99E0462	Yes	No	No	Yes	Spread	Stake-Holes	No	MBA
CO16	Cork	Meenane	99E0705	Yes	Yes	Poss.	Yes	Spread	Post-Holes	No	LBA
CO17a	Cork	Mitchellsfort	99E0673	Yes	No	No	No	Spread	No	No	
CO17b	Cork	Mitchellsfort	99E0673	Yes	No	No	Yes	Spread	No	No	
CO17c	Cork	Mitchellsfort	99E0673	No	No	No	No	Spread	No	No	
CO18	Cork	Butlerstown Little	99E0437	Yes	Yes	No	Yes	Mound	Stone surface	Yes	
CO19	Cork	Killeens	99E0503	Yes	No	No	No	Mound	Stone surface	No	
CO20	Cork	Monard	99E0478	Yes	Yes	No	No	Mound	No	No	
CO21	Cork	Killalough	00E0009	Yes	Yes	No	No	Spread	No	No	MBA
CO22	Cork	Ballinvinny South	00E0251	No	Yes	No	No	Mound	No	No	MBA
CO23	Cork	Derrigra East	00E0638	Yes	No	No	No	Spread	No	No	
CO24	Cork	Derrycool	00E0588	Yes	No	No	No	Mound	Stone stockpile	No	
CO25	Cork	Dromvane II	00E0637	Mult	Poss.	No	No	Mound	No	No	
CO26	Cork	Teadies Upper I	00E0584	Yes	No	No	No	Mound	No	No	
CO27	Cork	Teadies Upper II	00E0585	Yes	No	No	No	Mound	No	Yes	
CO28	Cork	Meenane	01E0691	Yes	No	No	Yes	Spread	Stake-Holes	Yes	LBA
CO29	Cork	Propoge	01E0861	Yes	No	No	No	Spread	No	No	LBA
CO30	Cork	Clashadunna East	01E0728	Yes	No	No	No	Spread	No	Yes	MBA
CO31	Cork	Muckridge	01E0430	Yes	No	Poss.	Mult	Spreads	Stake-Holes	No	CL
CO32	Cork	Maglin	01E0729	No	No	No	Yes	Spread	No	No	EBA
CO33	Cork	Maglin	01E0756	Yes	No	No	Yes	Spread	No	No	
CO34	Cork	Curraheen	01E1217	Yes	No	No	No	Spread	No	No	
CO35	Cork	Transtown	01E0647	No	No	No	No	Spread	No	No	MBA
CO36	Cork	Curraheen	02E1297	Yes	No	Poss.	Mult	Mound	stone surface	Yes	LBA–A
CO37a	Cork	Curraheen	02E1298	No	No	No	No	Spread	No	No	CL

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
CO37b	Cork	Curraheen	02E1298	No	No	No	Yes	No	No	No	CL
CO37c	Cork	Curraheen	02E1298	No	No	No	Yes	Spreads	No	No	LBA
CO37d	Cork	Curraheen	02E1298	No	No	No	No	Spread	No	No	LBA
CO37e	Cork	Curraheen	02E1298	Yes	Yes	No	Yes	Spread	No	No	LBA
CO38f	Cork	Curraheen	02E1298	Yes	No	No	Yes	No	No	No	
CO37g	Cork	Curraheen	02E1298	Yes	No	No	Yes	No	No	No	LBA
CO38	Cork	Carrigrohane	01E0444	Poss.	No	No	Mult	Mound	No	No	
CO39	Cork	Ballinaspig More	01E0546	No	No	No	No	Spreads	No	No	
CO40	Cork	Ballinaspig More	01E0546	Poss.	Yes	No	No	Spread	No	No	
CO41	Cork	Ballinaspig More	01E0546	Yes	No	No	No	Spread	No	No	
CO42	Cork	Ballinaspig More	02E1230	Yes	No	No	Yes	Mound	Stake revetment/ windbreak	No	CL
CO43	Cork	Ballinaspig More	02E1233	Mult	Yes	Yes	No	Mound	Water-channel, platform, Stake-holes	Yes	BA*
CO44	Cork	Aughinida	02E1039	Yes	No	No	Yes	Mound	Stake-holes	No	
CO45	Cork	Ballynahina	03E1186	Mult	No	No	Mult	Mound	Water-channel	No	LBA
CO46	Cork	Corrin	03E1463	Yes	No	No	Yes	Mound	Stake-holes	Yes	
CO47	Cork	Corrin	03E1636	Mult	No	No	No	Spreads	No	Yes	CL
CO48	Cork	Fermoy	03E1465	Yes	No	No	No	Spreads	No	No	LBA
CO49a	Cork	Fermoy	03E0979	No	No	No	Yes	No	No	No	EN
CO49b	Cork	Fermoy	03E0979	Mult	No	No	Poss.	Spread	Post-holes/pits	Yes	CL
CO49c	Cork	Fermoy	03E0979	Yes	No	No	Mult	Mound	Well	No	EBA
CO49d	Cork	Fermoy	03E0979	Yes	No	No	No	Spread	Stake-holes	No	MBA
CO50	Cork	Fermoy	03E1639	Yes	Yes	No	Yes	Spread	No	No	LBA
CO51	Cork	Kilbrien	03E1088	Yes	No	No	Yes	No	Stake-holes	Yes	MBA
CO52	Cork	Lisnagar Demesne	03E1461	Yes	No	Yes	Yes	Spreads	Stake-holes	No	EBA
CO53	Cork	Lisnagar Demesne	03E1459	Yes	No	No	Yes	Spread	No	No	LBA
CO54	Cork	Scartbarry	03E1437	Mult	Yes	Yes	Yes	Mound	Windbreak, water–channels	No	MBA
CO55	Cork	Barrees	02E914	No	No	No	No	Mound	No	No	MBA
CO56	Cork	Barrees	02E914	No	No	No	No	Mound	No	No	LBA
CO57	Cork	Garranes	04E0457	Yes	Yes	Yes	Yes	Spread	Stone structure and Water-channel	Yes	MBA–LBA
CO58	Cork	Fermoy Wood	04E1014	Yes	No	No	Yes	Mound	Post-holes	No	IA
CO59	Cork	Mitchelstown	04E1071	No	No	No	Yes	Spread	No	Yes	EBA
CO60	Cork	Stagpark	04E1119	Yes	No	No	Yes	Mound	Post-holes	No	EBA
CO61	Cork	Stagpark	04E1119	Yes	No	No	Yes	Spread	Post-holes	Yes	EBA
CO62	Cork	Barnahely	04E1246	Mult	Yes	Yes	Mult	Spread	Windbreak and post–structures	Yes	IA
CO63	Cork	Scartbarry	A014/002	Yes	No	No	Yes	Mound	Stake-holes	No	LBA–IA
CO64	Cork	Fermoy	05E078	Mult	Yes	Poss.	Yes	Mound	Stone surface	Yes	CL–LBA
CO65	Cork	Carrigane	E2303	Yes	No	No	Yes	Mound	No	No	EBA
CO66	Cork	Carrigane	E2303	Yes	No	No	No	Mound	No	No	MBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
CO67	Cork	Carrigane	E2303	Yes	No	No	Yes	Mound	No	No	MBA
CO68	Cork	Gortnahown	E3832	No	No	No	Yes	Spread	No	No	
CO69	Cork	Kildrum	E3971	Mult	No	No	Yes	Mound	No	No	CL
CO70	Cork	Kilshanny	E2432	Yes	No	No	Yes	Mound	No	No	LBA
CO71	Cork	Ballinglanna North	E2414	Yes	No	No	Yes	Mound	Water-channel	Yes	IA
CO72	Cork	Ballynamona	E2429	Yes	Yes	No	Yes	Mound	Ring-ditch	No	MBA
CO73a	Cork	Ballinglanna North	E2416	Mult	No	No	Yes	Mound	No	No	CL
CO73b	Cork	Ballinglanna North	E2417	Mult	No	No	Mult	Mound	No	No	EBA
CO74	Cork	Caherdrinny	E2420	No	No	No	No	Spread	No	No	
CO75	Cork	Ballyadam	06E612	Mult	No	No	Mult	Mound	Stake-Holes and water–channels	No	CL
CO76	Cork	Ballyadam	06E612	Mult	No	No	Mult	Mound	Stake-Holes	No	EBA–LBA
CO77	Cork	Ballyadam	06E612	Yes	No	No	No	Spread	No	No	CL
CO78	Cork	Ballyadam	06E612	Yes	No	No	Mult	Mound	Stake-Holes	No	EBA
CO79	Cork	Carrigtwohill	06E1141	Yes	No	No	Yes	Mound	Water cistern and ring-ditch	Yes	LBA
CO80	Cork	Burgersland	07E771	No	No	No	Yes	Mound	No	No	
CO81	Cork	Carrignafoy	07E217	Mult	Yes	Yes	Yes	Mound	Structure, water–channels	Yes	
CO82	Cork	Cappagh	06E110	Yes	Yes	No	No	Mound	No	No	MBA
CO83	Cork	Ballinveiltig	08E665	No	Yes	No	Yes	Spread	No	No	CL
CO84	Cork	Curraheen	08E665	No	Yes	No	Yes	Spread	Water-channel	No	EM
CO85	Cork	Castlemary	08E177	No	No	No	No	Spread	No	No	MBA
CO86	Cork	Castlemary	08E311	No	No	No	Yes	No	No	No	MBA
CO87	Cork	Ballynacorra West	08E295	No	No	No	Yes	Mound	No	No	LBA
CO88	Cork	Ballynacorra West	08E296	No	No	No	No	Spread	No	No	EBA
CO89	Cork	Ardnabourkey	08E350	No	No	No	No	Spread	No	No	EBA
CO90	Cork	Bawnard East	08E168	No	No	No	No	Mound	No	No	LBA
CO91	Cork	Ballincarroonig	08E440	No	No	No	No	Mound	No	No	LBA
CO92	Cork	Crocane	08E310	No	No	No	Yes	Spread	No	No	LBA
CO93	Cork	Walshtown Beg	09E247	Yes	No	No	Yes	Mound	Stone surface and water–channel	Yes	EBA
CO94	Cork	Coolmoohan	09E198	Yes	Yes	Yes	Yes	Mound	Well and structure	No	LBA
CO95	Cork	Castlecooke	09E194	Mult	No	No	Yes	Mound	No	No	EBA
CO96	Cork	Curragh Upper	09E210	Mult	Yes	No	Mult	Mound	Stone surfaces and Stake-Holes	Yes	LBA
CO97	Cork	Macroney Upper	09E197	Mult	No	Poss.	Mult	Mound	Stone surfaces and Stake-Holes	Yes	MBA
CO98	Cork	Castlecooke	09E195	Yes	No	No	Yes	Mound	Stake-Holes	No	MBA
CO99	Cork	Killeagh	09E264	Mult	Yes	No	Mult	Mound	Water–channels and Stake-Holes	No	MBA
CO100	Cork	Ballard	09E059	Yes	No	No	Yes	No	No	No	LBA
CO101	Cork	Coole Lower	09E059	No	No	No	No	Mound	No	No	EBA
CO102	Cork	Ballyvolane	09E059	Yes	No	No	No	No	No	No	

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CO103	Cork	Walshtownmore	09E059	Yes	No	No	Yes	Spread	No	No	LBA
CO104	Cork	Barnashillane	09E059	No	No	No	No	Spread	No	No	
DY01	Derry	Coolkeeragh	AE/02/56	Yes	No	No	Yes	Mound	Roasting pits?	Yes	
DY02	Derry	Gransha	AE/02/76	Yes	No	Poss.	Yes	Mound	Stake-Holes	Yes	EBA
DY03	Derry	Macosquin	AE/02/130	No	No	No	No	Spreads	Poss. metalworking pits	Yes	
DY04	Derry	Ballymenagh	AE/04/100	No	No	No	Yes	Spread	No	No	
DY05	Derry	Ballynacallymore	AE/04/91	No	No	No	No	Spread	No	No	
DY06	Derry	Coolagh	AE/03/140	No	No	No	No	Spread	No	No	
DL01	Donegal	Killybegs	01E0895	Poss.	No	No	No	Mound	No	No	
DL02	Donegal	Killybegs	01E0065	Yes	No	No	No	Mound	No	No	
DL03	Donegal	Conwal	04E1473	No	No	No	No	Spread	No	No	
DW01a	Down	Ballycroghan	Unknown	Yes	Yes	No	No	Mound	Platform	No	
DW01b	Down	Ballycroghan	Unknown	No	No	No	Yes	Mound	No	No	
DW01c	Down	Ballycroghan	Unknown	Yes	Poss.	Yes	No	Mound	No	No	
DW01d	Down	Ballycroghan	Unknown	Yes	No	No	No	Spread	Stone stockpile	Yes	
DW02	Down	Drumaroad	AE/00/09	No	No	No	No	Mound	No	No	
DW03	Down	Edendariff	AE/00/01	Poss.	No	No	No	Spread	Stake-Holes	No	
DW04	Down	Breezmount	AE/01/85	Yes	No	No	No	Mound	No	No	
DW05	Down	Killinure	AE/01/83	Yes	No	Poss.	No	Spread	Post-holes	Yes	
DW06	Down	Carricknaveagh	AE/01/21	Yes	Yes	No	Yes	Spread	Quarry pits and slot-trench	No	
DW07	Down	Carricknaveagh	AE/01/23	Yes	No	No	No	Spread	No	No	
DW08	Down	Clontakelly	AE/01/1	Yes	No	No	No	Spread	No	No	
DW09	Down	Carnreagh	AE/03/98	Yes	No	No	No	Spread	No	Yes	
DW10a	Down	Baloo Lower	AE/06/196	No	No	No	No	Mound	No	No	EBA
DW10b	Down	Baloo Lower	AE/06/197	Poss.	No	No	Yes	No	No	No	EBA
DW10c	Down	Baloo Lower	AE/06/198	Yes	No	No	Yes	Mound	Well?	No	LBA
DW10d	Down	Baloo Lower	AE/06/199	No	No	No	Yes	Mound	No	No	EBA
DW11	Down	Ballywilliam	AE/06/65	Mult	No	No	Mult	Mound	No	Yes	EBA
DW12	Down	Edenderry	AE/06/46	Yes	No	No	Mult	Mound	Stake-holes, Water-channels and slot-trench	No	
DN01	Dublin	Ballyman	E182	No	No	No	No	Spread	Poss. roasting oven	Yes	EM
DN02	Dublin	Shankill	98E0445	Yes	Yes	Poss.	Yes	Mound	Stake-Holes	Yes	
DN03	Dublin	Kingstown	98E0518	Yes	Yes	No	No	Spread	Water–channel and Stake-Holes	Yes	BA
DN04a	Dublin	Cherrywood	98E0526	Mult	Yes	No	No	Spread	No	Yes	
DN05	Dublin	Cherrywood	99E0518	Yes	No	No	No	Spread	ardmarks	No	
DN06	Dublin	Newtown	99E0344	Yes	No	No	Yes	Spread	No	No	EBA
DN07	Dublin	Fonthill	00E0447	No	No	No	No	Spread	No	No	
DN08	Dublin	Coldwinter	01E1062	Yes	No	No	No	Spread	Stake-Holes	No	MBA
DN09	Dublin	Carmanhall	02E0330	Yes	No	No	No	Spread	No	Yes	LBA
DN10	Dublin	Jordanstown	02E0686	Yes	No	No	No	Spread	No	No	
DN11	Dublin	Knock	02E0683	Yes	No	No	No	Spread	Post-Holes	No	

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DN12	Dublin	Knock	02E0685	Yes	No	No	No	Spread	No	No	
DN13	Dublin	Murphystown	02E0153	No	No	No	No	Spread	No	No	
DN14	Dublin	Murphystown	02E0699	Yes	No	No	No	Spread	No	Yes	
DN15	Dublin	Carrickmines Great	02E0428	Yes	Yes	No	No	Spread	Stone surface	Yes	EBA
DN16	Dublin	Laughanstown	02E1133	Yes	No	Poss.	Yes	Mound	Wells	Yes	EBA–LBA
DN17	Dublin	Oldcourt	02E1374	Yes	Yes	No	Mult	Spread	Stone surface, and Post-Holes	Yes	
DN18	Dublin	Roganstown	02E0771	No	No	No	No	Spread	No	No	
DN19	Dublin	Staffordstown	01E0831	Yes	Yes	No	No	Spread	No	No	
DN20	Dublin	Thomondtown	01E1160	Yes	No	No	No	Spread	No	No	
DN21	Dublin	Woodpark	01E1156	Yes	No	No	No	Spread	No	No	
DN22	Dublin	Lusk	02E1399	Yes	No	No	Yes	Spread	Well	Yes	
DN23	Dublin	Newtown	03E1450	Yes	No	No	Yes	Spread	Platform	No	
DN24	Dublin	Ward Lower	03E1356	Yes	Yes	No	Yes	Mound	No	No	EBA
DN25	Dublin	Ballynakelly	03E0369	Yes	No	No	No	Spread	No	No	
DN26	Dublin	Grange	04E0352	Poss.	No	No	No	Spread	No	No	
DN27	Dublin	Grange	04E0701	Yes	No	No	Yes	Spread	No	Yes	
DN28	Dublin	Kilgobbin	04E0701	No	No	No	No	Spread	No	No	
DN29	Dublin	Taylorsgrange	05E1178	No	No	No	No	Spread	Walls	Yes	
DN30	Dublin	Kilsallaghan	07E0326	No	No	No	Yes	Spread	No	No	
DN31	Dublin	Ballynakelly	07E0245	Mult	No	No	Yes	Spread	Well	Yes	
DN32	Dublin	Jamestown	98E0119	Yes	No	No	No	Mound	No	No	LN
FH01	Fermanagh	Derryharney	Unknown	Poss.	No	No	Yes	Mound	Poss. ramp	No	
FH02	Fermanagh	Derrybrusk	Unknown	Mult	No	No	No	Mound	Log Boats	Yes	LBA
FH03a	Fermanagh	Derryvullan	Unknown	Poss.	No	No	Yes	Mound	No	No	BA
FH03b	Fermanagh	Derryvullan	Unknown	Poss.	No	No	Yes	Mound	No	No	
FH04	Fermanagh	Enniskillen	Unknown	Poss.	No	No	Poss.	Mound	No	Yes	
FH05	Fermanagh	Rossmacaffry	AE/07/78	Yes	No	No	Yes	Mound	No	Yes	EBA
GY01a	Galway	Doughiska	95E99	No	No	No	No	Mound		Yes	EBA
GY01b	Galway	Doughiska	95E99	No	No	No	No	Mound	Poss. revetment	No	
GY01c	Galway	Doughiska	95E99	Poss.	No	Poss.	Yes	Mound	Stake-Holes	No	MBA
GY02	Galway	Brackernagh	02E1190	Yes	No	No	No	Spread	Platform?	No	
GY03	Galway	Perssepark	02E0564	Yes	No	No	No	Mound	Platform?	No	
GY04	Galway	Lissarulla	04E0810	No	No	No	Yes	Spread	No	Yes	
GY05	Galway	Greeneenagh	04E1506	Yes	No	Yes	Yes	Mound	Stake-holes	Yes	LBA
GY06	Galway	Cloonbar	05E0766	Yes	No	No	No	Mound	No	No	EBA
GY07	Galway	Dunmore	06E0605	Yes	No	No	No	Mound	No	No	
GY08	Galway	Furzypark	E2553	No	Poss.	No	Yes	Spread	No	Yes	MBA
GY09	Galway	Newford	E2437	Poss.	No	No	Yes	Mound	Well and Cremation Pyre	No	Neo
GY10	Galway	Clogharevaun	E2056	Yes	No	No	No	Spread	No	No	MBA
GY11	Galway	Barnacragh	E2446	Yes	No	No	Yes	Mound	Water-channel and Stake-Holes	Yes	EBA
GY12	Galway	Cooltymurraghy	E2448	No	No	No	No	Spread	No	No	EBA

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GY13	Galway	Urraghry	E2449	Yes	No	No	No	Spread	Water-channels with Stake-Holes	Yes	EBA
GY14a	Galway	Doughiska	E2052	No	No	No	No	Mound	Horse Burial	No	EBA–LBA
GY14b	Galway	Doughiska	E2052	No	No	No	No	Mound	No	No	EBA
GY14c	Galway	Doughiska	E2052	No	No	No	No	Mound	No	No	MBA–LBA
GY14d	Galway	Doughiska	E2052	No	No	No	Yes	Spread	No	No	EM
GY15	Galway	Caraun More	E2074	No	No	No	No	Mound	Natural gullies for water collection	No	LBA
GY16	Galway	Caraun More	E2055	Yes	No	No	Mult	Mound	Cistern	No	LBA
GY17	Galway	Caraun More	E2072	Yes	Yes	Yes	Poss.	Spread	No	Yes	MBA
GY18	Galway	Killescragh	E2070	Yes	Yes	Poss.	No	Mound	Platform/ trough	No	EBA–LBA
GY19	Galway	Killescragh	E2071	No	No	No	No	Mound	Two trackways and wooden features	Yes	EBA–LBA
GY20	Galway	Ballinillaun	E3888	Mult	No	No	No	Spread	Post–hole	Yes	LBA
GY21	Galway	Ballinillaun	E3886	No	No	No	Mult	Destroyed	No	No	EBA
GY22	Galway	Moyveela	E3883	Yes	No	No	Yes	Spread	No	No	LBA
GY23	Galway	Moyveela	E3884	Yes	No	No	Yes	Spread	Post-Holes?	No	LBA
GY24	Galway	Coldwood	E3887	No	No	No	No	Spread	No	Yes	BA?
GY25	Galway	Caherweelder	E3880	Yes	No	No	Yes	Spread	Well	No	LBA
GY26	Galway	Caherweelder	E3895	Yes	No	No	Yes	Spread	No	No	MBA
GY27	Galway	Caherweelder	E3889	Yes	No	No	No	Mound	No	No	MBA
GY28	Galway	Caherweelder	E3866	Yes	No	No	No	Mound	No	Yes	EBA–LBA
GY29	Galway	Caherweelder	E2449	Mult	No	No	No	Mound	Stockpile	Yes	EBA–MBA
GY30	Galway	Roevehagh	E3885	Yes	No	No	Yes	Spread	No	No	LBA
GY31	Galway	Ballyglass West	E3870	Mult	No	Yes	Yes	Mound	Well and Water-channel	Yes	EBA–LBA
GY32a	Galway	Dunlo	08E653	Yes	No	No	No	Mound	No	Yes	MBA–LBA
GY32b	Galway	Dunlo	08E653	No	No	No	No	Spread	No	No	BA?
GY32c	Galway	Dunlo	08E653	Poss.	No	No	Yes	Spread	Well?	No	IA
GY33	Galway	Annagh Hill	E4093	No	No	No	Yes	Spread	No	No	
GY34	Galway	Ardskea Beg	E4090	Yes	Yes	No	Yes	Mound	Stake-Holes and water–channel	No	
GY35	Galway	Cloondarone	E4062	No	No	No	No	Spread	No	No	
GY36	Galway	Cloondarone	E4062	No	No	No	No	Mound	No	No	
GY37	Galway	Cloondarone	E4062	Yes	No	No	No	Spread	No	No	
GY38	Galway	Cloondarone	E4062	Yes	No	No	Yes	Mound	No	No	
GY39	Galway	Cloondarone	E4063	Yes	No	No	No	Spread	No	No	
GY40	Galway	Cloondarone	E4063	Yes	No	No	No	Spread	No	No	
GY41	Galway	Cloondarone	E4065	No	No	No	No	Spread	No	No	
GY42	Galway	Cloondarone	E4065	Yes	No	No	No	Mound	No	No	
GY43	Galway	Cloondarone	E4065	Yes	No	No	No	Spread	No	No	
GY44	Galway	Cloondarone	E4066	No	No	No	No	Spread	No	No	

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KY01	Kerry	Dromkeen East	Unknown	Yes	No	No	Yes	Mound	No	No	
KY02	Kerry	Rathmore	Unknown	Yes	No	No	No	Destroyed	No	No	EBA
KY03	Kerry	Coarhamore	E478	Yes	No	Yes	No	Mound	Paving and revetment	Yes	LBA
KY04a	Kerry	Dromthacker	97E0022	No	No	No	No	Spread	No	No	
KY04b	Kerry	Dromthacker	97E0022	Yes	Poss.	No	No	Mound	No	Yes	EBA
KY05	Kerry	Buntalloon	99E0553	Poss.	No	No	Yes	No	Stake-holes	No	MBA
KY06a	Kerry	Cloghers	00E0065	Yes	No	No	No	Spread	Stake-holes	No	
KY06b	Kerry	Cloghers	00E0065	Yes	No	No	Yes	Spread	Linear feature	No	EBA
KY07	Kerry	Flemby	00E0245	Yes	No	No	No	Spread	No	No	
KY08	Kerry	Groin	01E0095	Yes	No	No	Yes	Spread	Revetment	No	
KY09	Kerry	Coolgarriff	01E0083	Yes	No	No	No	Spread	Revetment and stone trackway	No	IA
KY10a	Kerry	Ballydowney	02E0055	Yes	Yes	No	No	Spread	Stake holes	No	EBA
KY10b (i–ii)	Kerry	Ballydowney	02E0055	Yes	No	No	Yes	Spread	No	No	
KY10c	Kerry	Ballydowney	02E0055	Yes	Yes	No	Mult	Spread	Stone stockpile	Yes	
KY10d	Kerry	Ballydowney	02E0055	Yes	Yes	No	No	Spread	No	No	MBA
KY11	Kerry	Ballingowen	03E1716	Yes	No	No	No	Spread	No	No	
KY12	Kerry	Farranastack	03E0171	Poss.	No	No	Mult	No	ditch	No	LBA
KY13	Kerry	Garraunderragh	04E0646	Yes	No	No	No	Spread	No	No	MBA
KY14	Kerry	Garraunderragh	04E0647	Yes	No	No	No	Mound	Well and water-channels	No	LBA
KY15	Kerry	Urrohogal	04E0647ext	Yes	No	No	Yes	Spread	No	No	LBA
KY16	Kerry	Kilmaniheen West	04E0974	Yes	No	No	No	Spread	No	No	LBA
KY17	Kerry	Kilmaniheen West	04E0966	Yes	No	No	No	Mound	No	No	LBA
KY18	Kerry	Dromore	05E0581	No	No	No	No	Mound	Poss. Trackway	No	LBA
KY19a	Kerry	Ballynahoulort	05E1292ext	Poss.	Poss.	No	Mult	Spread	No	No	
KY19b	Kerry	Ballynahoulort	05E1292ext	Poss.	No	No	Yes	Spread	Stake-holes	No	
KY19c	Kerry	Ballynahoulort	05E1292ext	No	No	No	No	Spread	No	No	
KY20	Kerry	Skahanagh	06E0290	Poss.	No	No	Yes	Spreads	No	No	LBA
KY21a	Kerry	Dromnevane	07E0678	Yes	No	No	No	Mound	No	No	
KY21b	Kerry	Dromnevane	07E0678	Yes	No	No	No	Mound	No	No	
KY22	Kerry	Caherleaheen	07E0306	No	Poss.	No	Yes	Spreads	No	No	EBA–LBA
KD01	Kildare	Rinawade Upper	95E264	Poss.	No	No	Yes	Spread	No	No	
KD02	Kildare	Mayfield	98E0288	Yes	No	No	No	Spread	No	No	
KD03	Kildare	Ballyvass	99E0453	Yes	No	No	No	Spread	No	Yes	
KD04	Kildare	Kilmacredock Upper	01E0998	No	No	Poss.	Yes	Spread	Cremation?	Yes	
KD05a	Kildare	Carton Demesne	01E0199	No	No	No	No	Spread	No	Yes	
KD05b	Kildare	Carton Demesne	01E0199	Yes	No	No	No	Spread	No	Yes	
KD06	Kildare	Carton Demesne	01E0379	Yes	No	No	No	Spread	No	Yes	
KD07	Kildare	Cherryville	01E0304	No	No	No	Yes	Spread	No	Yes	EBA–MBA
KD08	Kildare	Cherryville	01E0350	No	No	No	Yes	Spread	Stake-holes	No	EBA
KD09a	Kildare	Cherryville	01E0583	Yes	No	No	Mult	Spread	Stake-holes	Yes	MBA
KD09b	Kildare	Cherryville	01E0583	Yes	No	No	No	Spread	No	Yes	LN
KD10	Kildare	Cherryville	01E0479	No	No	No	No	Mound	No	Yes	EN–MN

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KD11	Kildare	Loughlion	01E0846	No	No	Poss.	Mult	Spread	No	Yes	EBA
KD12	Kildare	Kilmorebrannagh	02E1075	Yes	Yes	No	Yes	Spread	No	Yes	EBA
KD13	Kildare	Killickaweeny	02E0987	Yes	Poss.	No	Yes	Spread	No	Yes	
KD14	Kildare	Ballynakill	03E0987	No	No	No	No	Spread	No	No	EBA
KD15	Kildare	Ballyburn Lower	E2565	Yes	No	No	Yes	Spread	Stake-Holes	No	EBA
KD16	Kildare	Ballyburn Lower	E2566	Poss.	No	Poss.	Yes	Spread	Water–channel	Yes	LBA–IA
KD17	Kildare	Prumplestown	E2624	Yes	No	No	Mult	Mound	No	Yes	EBA
KD18	Kildare	Ballyburn Lower	E2563	Yes	No	No	Yes	Mound	No	No	EBA
KD19	Kildare	Burtonhall Demesne	E2567	Yes	No	No	No	Spread	No	No	IA
KD20	Kildare	Boleybeg	E2855	Yes	No	No	Yes	Spread	Stone stockpile	Yes	LIA–EM
KD21	Kildare	Mullamast	E2858	Yes	No	Poss.	No	Mound	Stake-Holes, Platform and Poss. trackway	Yes	EBA
KD22	Kildare	Inchaquire	E2867	Yes	Yes	No	Yes	Spread	Cist burial and well	Yes	EBA–MBA
KD23	Kildare	Inchaquire	E2867	Yes	No	No	Yes	Spread	Well and metalled surface	Yes	EBA
KD24	Kildare	Blackrath	E2871	No	No	No	Yes	Spread	later activity	No	EBA
KD25	Kildare	Ballymount	E2872	Yes	No	No	Yes	Mound	Stake-Holes	Yes	LN
KD26	Kildare	Ballymount	E2873	Yes	No	No	Yes	Spread	Water-channel and Stake-Holes	Yes	EBA
KD27	Kildare	Ballymount	E2874	Yes	No	Yes	No	Spread	stone structure	No	LBA
KD28	Kildare	Kilgowen	E2886	Yes	No	No	Mult	Spread	No	Yes	EBA
KD29	Kildare	Old Kilcullen	E2887	No	No	No	No	Spread	No	No	EBA
KD30	Kildare	Ballyvass	E2939	No	No	No	Yes	Spread	No	No	LM
KD31	Kildare	Ballynamony	E2952	Yes	No	Poss.	No	Spread	Stake–Fence	Yes	EIA
KD32	Kildare	Belan	E2953	Yes	No	No	No	Spread	No	Yes	EBA
KD33	Kildare	Moone	E2981	Mult	No	No	Yes	Spread	Well and stone stockpile	Yes	IA
KD34	Kildare	Gallowshill	E2993	Yes	No	No	No	Spread	Truncated site	No	EBA
KD35	Kildare	Coolane	E2993	Yes	No	No	Yes	Spread	Post-Holes	No	
KD36	Kildare	Woodlands East	E2955	Yes	No	No	Yes	Mound	Stake-Holes	Yes	EBA
KD37a	Kildare	Woodlands East	E2956	No	No	No	Yes	Mound	No	No	
KD37b	Kildare	Woodlands East	E2956	Yes	No	No	Yes	Mound	No	No	LBA
KD38	Kildare	Prumplestown Lower	E2967	Yes	No	No	No	Spread	Trackway	Yes	LBA
KK01a	Kilkenny	Catstown	E151	Yes	No	No	No	Mound	No	Yes	IA
KK01b	Kilkenny	Catstown	E151	Poss.	Poss.	No	Yes	Mound	Stone setting	No	MED
KK02	Kilkenny	Clohoge	Unknown	No	No	No	No	Mound	No	No	
KK03	Kilkenny	Bonnetstown	99E0601	Yes	No	No	No	Mound	No	No	MBA
KK04	Kilkenny	Castleinch	99E0603	Yes	No	No	Yes	Mound	Stockpile and working surface	Yes	LBA
KK05	Kilkenny	Grange	99E0600	Yes	No	No	Yes	Spread	No	No	MBA
KK06	Kilkenny	Parksgrove	99E0597	No	No	No	Yes	Mound	Furnace	Yes	IA
KK07	Kilkenny	Parksgrove	99E0598	Mult	No	No	No	Mound	No	Yes	LBA

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KK08	Kilkenny	Parksgrove	99E0599	No	Yes	No	No	Spread	No	No	IA
KK09	Kilkenny	Castletown	00E0048	Yes	No	No	Yes	Spread	No	No	
KK10	Kilkenny	Castletown	00E0049	Yes	No	No	No	Spread	No	No	
KK11	Kilkenny	Castletown	00E0079	Yes	Yes	No	Yes	Spread	No	No	
KK12	Kilkenny	Kilmurry	03E0861	Mult	Yes	No	No	Spread	No	No	MBA
KK13	Kilkenny	Killaspy	03E0619	Poss.	No	No	Mult	Mound	Stone pathway	Yes	CL
KK14	Kilkenny	Ballynamona	03E0865	Mult	Poss.	No	Yes	Mound	Oven, trackways, water–channels	No	MBA
KK15	Kilkenny	Dunkitt	03E0911	Yes	No	No	Yes	Spread	Well	Yes	LBA
KK16	Kilkenny	Ballymountain	04E0331	Mult	No	No	Mult	Mound	Revetment, Stake-Holes	Yes	MBA
KK17	Kilkenny	Killaspy	04E0257	Yes	No	No	Yes	Mound	Cobbled surface and Stake-Holes	No	LBA
KK18	Kilkenny	Rathpatrick	04E0298	Mult	No	No	Yes	Spread	Stockpile	Yes	EBA
KK19	Kilkenny	Rathpatrick	04E0318	Yes	Yes	Yes	Yes	Mound	Stone pathway, structure	Yes	LBA–IA
KK20	Kilkenny	Killaspy	04E0770	Yes	No	No	Yes	Mound	Stake-Holes, water–channel		MBA–LBA
KK21	Kilkenny	Rathpatrick	04E0318	Yes	No	No	Yes	Mound	No	Yes	LBA
KK22	Kilkenny	Newrath	04E319	Mult	No	No	Mult	Mound	Post-Holes	No	
KK23	Kilkenny	Newrath	E3198	Yes	Yes	No	No	Mound	No	No	MBA
KK24a	Kilkenny	Islands	E2386	Yes	No	No	Mult	Mound	Platform	Yes	EBA–LBA
KK24b	Kilkenny	Islands	E2386	Yes	NO	No	Yes	Mound	No	No	MBA
KK25	Kilkenny	Islands	E2387	No	No	No	Yes	Mound	No	No	MBA
KK26a	Kilkenny	Islands	E2388	Yes	No	No	No	Spread	No	No	LN
KK26b	Kilkenny	Islands	E2388	Yes	No	Poss.	Yes	Spread	Stake-holes	No	LBA
KK27	Kilkenny	Islands	E2389	Poss.	No	No	Yes	Spread	No	No	MBA–LBA
KK28a	Kilkenny	Warrenstown	E2390	Yes	No	No	No	Mound	No	No	EBA
KK28b	Kilkenny	Warrenstown	E2390	No	No	No	No	Spread	No	No	EBA
KK29a	Kilkenny	Foulkscourt	E2391	No	No	No	No	Spread	No	No	
KK29b	Kilkenny	Foulkscourt	E2391	No	No	No	No	Spread	No	No	
KK29c	Kilkenny	Foulkscourt	E2391	Yes	No	No	Yes	Spread	Post-Holes	No	LBA
KK29d	Kilkenny	Foulkscourt	E2391	No	No	No	Yes	Spread	No	No	MBA
KK29e	Kilkenny	Foulkscourt	E2391	No	No	No	No	Spread	No	No	
KK29f	Kilkenny	Foulkscourt	E2391	No	No	No	Mult	Spread	No	No	
KK29g	Kilkenny	Foulkscourt	E2391	Yes	No	No	No	Mound	No	No	MBA
KK29h	Kilkenny	Foulkscourt	E2391	No	No	No	Yes	Spread	No	No	LBA
KK30a	Kilkenny	Glashare	E2394	Mult	No	No	No	Mound	No	Yes	LBA
KK30b	Kilkenny	Glashare	E2394	Yes	No	No	No	No	No	No	
KK30c	Kilkenny	Glashare	E2394	No	No	No	No	Spread	No	No	
KK31	Kilkenny	Ballinvally	E3836	No	No	No	Yes	No	No	No	EBA
KK32	Kilkenny	Ballyquirk	E3863	Yes	No	No	Yes	No	No	No	CL
KK33a	Kilkenny	Ballyquirk	E3848	Yes	No	No	Mult	Spread	No	No	
KK33b	Kilkenny	Ballyquirk	E3848	Yes	Yes	Poss.	Mult	Mound	No	No	MBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
KK33c	Kilkenny	Ballyquirk	E3848	No	Yes	Yes	No	Mound	Enclosing Palisade	Yes	
KK33d	Kilkenny	Ballyquirk	E3848	Yes	No	No	Poss.	No	Post-holes	Yes	MBA
KK34a	Kilkenny	Baysrath	E3629	No	No	Yes	Yes	Yes	Post-holes	No	MBA
KK34b	Kilkenny	Baysrath	E3629	No	No	No	Yes	Spread	No	No	LBA
KK35	Kilkenny	Blanchvillespark	E3913	No	Yes	Yes	Yes	Spread	Water–channel	No	MBA
KK36	Kilkenny	Danesfort	E3460	Yes	No	No	Mult	No	No	No	CL
KK37	Kilkenny	Holdenstown	E3682	Yes	No	No	Mult	Mound	No	Yes	IA
KK38	Kilkenny	Knockadrina	E3677	Yes	No	No	Mult	No	Post-holes	No	EBA
KK39	Kilkenny	Maddockstown	E3677	Yes	No	No	Yes	Mound	Well	No	LBA
KK40	Kilkenny	Rathcash	E3859	Yes	No	Yes	Yes	Spread	No	Yes	LBA
KK41a	Kilkenny	Rathcash	E3860	No	No	No	Yes	Spread	No	Yes	MBA
KK41b	Kilkenny	Rathcash	E3860	Yes	No	No	Yes	Spread	Well	No	EBA–IA
KK42	Kilkenny	Rathcash East	E3893	Yes	No	No	Yes	Spread	No	No	EBA
KK43	Kilkenny	Rathduff Upper	E3612	Yes	No	No	No	Mound	No	Yes	MBA
KK44	Kilkenny	Rathduff Bayley	E4011	No	No	No	No	Mound	No	No	MBA
KK45	Kilkenny	Rathduff Upper	E3613	Yes	No	No	Mult	Mound	No	Yes	EBA–MBA
KK46	Kilkenny	Rathgarvin/Clifden	E3760	Yes	No	Poss.	Yes	Mound	Poss. well	Yes	EBA
KK47	Kilkenny	Stonecarthy West	E3974	Yes	No	No	Mult	Mound	No	No	EBA–MBA
KK48	Kilkenny	Knocktopher Commons	08E136	Mult	Poss.	No	No	Mound	No	Yes	EBA–IA
KK49a	Kilkenny	Ballykeoghan	E2999	Yes	No	No	Yes	Spread	Cobbled surface	No	CL
KK49b	Kilkenny	Ballykeoghan	E3000	Yes	No	Yes	Yes	Spread	Structure	Yes	LBA
KK50	Kilkenny	Blanchvillespark	E3914	Yes	No	No	Yes	Spread	No	No	EBA
KK51	Kilkenny	Blanchvillespark	E3914	Mult	No	No	Mult	Mound	Stake-holes, Cisterns?	No	LBA
KK52	Kilkenny	Danesfort	E3540	Mult	Yes	Poss.	Mult	Mound	Stake–hole structures and well	Yes	BA*
KK53a	Kilkenny	Danganbeg	E3606	Yes	No	Poss.	Yes	Spread	Well, stake–structure	Yes	MBA
KK53b	Kilkenny	Danganbeg	E3606	Yes	Poss.	No	Yes	Spread	Post-holes, well	Yes	IA
KK54	Kilkenny	Jordanstown	E3916	Yes	No	No	Yes	Spread	Cisterns and water–channel	Yes	EBA
KK55	Kilkenny	Kellymount	E3756	No	No	No	Yes	No	No	No	EBA
KK56	Kilkenny	Kellymount	E3757	Yes	No	Poss.	Mult	Mound	Stake–structure and well	Yes	EBA–MBA
KK57	Kilkenny	Kellymount	E3856	Mult	No	No	Mult	Mound	Well and Stake-holes/ windbreak	Yes	CL–IA
KK58a	Kilkenny	Kellymount	E3758	No	No	No	Yes	No	No	No	EBA
KK58b	Kilkenny	Kellymount	E3758	No	No	No	Yes	No	No	No	
KK58c	Kilkenny	Kellymount	E3758	No	No	No	No	Spread	No	No	
KK58d	Kilkenny	Kellymount	E3758	Yes	No	No	Yes	Spread	No	No	LBA
KK59	Kilkenny	Kilree	E3728	Yes	Yes	No	No	No	No	Yes	LBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
LS01	Laois	Derry	95E092	Yes	No	No	Yes	Spread	No	No	
LS02	Laois	Cloonaddadoran	96E345	Yes	No	No	No	Mound	No	No	LBA
LS03	Laois	Graigue	98E0382	No	No	No	No	Spreads	No	No	
LS04	Laois	Ballyshaneduff or The Derries	03E0662	Mult	No	No	Yes	Mound	Wells	Yes	
LS05	Laois	Ballyshaneduff or The Derries	03E0662	Yes	No	No	Yes	Mound	Well and stake-holes	No	
LS06	Laois	Morett	03E0804	Yes	No	No	Mult	Spread	Well and Poss. platform	No	
LS07	Laois	Addergoole	E2195	Mult	No	No	No	Spread	Palaeochannels	No	EBA–LBA
LS08	Laois	Addergoole	E2213	Mult	No	Yes	No	Spread	Palaeochannels	No	CL
LS09	Laois	Aghmacart	E2203	No	No	No	No	Mounds	Stone stockpile	No	LN
LS10	Laois	Aghmacart	E2204	Yes	No	No	No	Spread	Palaeochannel	No	CL
LS11	Laois	Ballycuddahy	E2425	Mult	No	No	Yes	Spread	No	No	CL
LS12	Laois	Ballyhinode	E2210	Poss.	No	No	Yes	Spread	No	No	
LS13	Laois	Ballyhinode	E2211	Poss.	No	No	Yes	Spread	No	No	
LS14	Laois	Boherard	E2238	Mult	No	No	Mult	Spread	No	No	EBA
LS15a	Laois	Boherard	E2239	Poss.	No	No	Yes	Spread	No	No	
LS15b	Laois	Boherard	E2239	Yes	Yes	No	No	Spread	No	No	EBA
LS15c	Laois	Boherard	E2239	Yes	Yes	No	Mult	Spread	No	Yes	
LS15d	Laois	Boherard	E2239	No	No	No	Yes	Spread	No	No	
LS16a	Laois	Boherard	E2227	Yes	No	No	Yes	Spread	No	No	MBA
LS16b	Laois	Boherard	E2227	Yes	No	No	Yes	Spread	Natural platforms	No	CL
LS17	Laois	Bushfield or Mahernaskeagh	E2226	Poss.	No	No	Yes	Spread	No	No	EM
LS18	Laois	Bushfield or Mahernaskeagh	E2225	Yes	No	No	Yes	Spread	Well	No	IA
LS19	Laois	Bushfield or Mahernaskeagh	E2220	Yes	No	No	No	Spread	No	No	CL
LS20	Laois	Cannonswood	E2201	Mult	No	Yes	No	Spread	Stake-Holes	No	EBA
LS21	Laois	Cappaloughlin	E2256	Yes	No	No	Yes	Spread	Well	No	LBA
LS22a	Laois	Cappaloughlin	E2257	Mult	No	No	Yes	Spread	Stake-Holes	No	EBA
LS22b	Laois	Cappaloughlin	E2257	Yes	No	No	No	Spread	No	No	LBA
LS22c	Laois	Cappaloughlin	E2257	Yes	No	No	Yes	Spread	No	No	EMA
LS23	Laois	Clonadacasey	E2260	Yes	No	No	No	No	No	No	MBA
LS24a	Laois	Clonadacasey	E2261	Yes	No	No	Yes	Mound	Well	No	LBA
LS24b	Laois	Clonadacasey	E2261	Yes	No	No	No	No	No	No	LBA
LS24c	Laois	Clonadacasey	E2261	Yes	No	No	No	No	No	No	LBA
LS25	Laois	Clonboyne	E2157	Yes	No	No	Yes	Spread	No	Yes	CL
LS26	Laois	Clonrud	E2264	Mult	No	No	No	Spread	No	No	EBA–MBA
LS27	Laois	Cooflin	E2229	Poss.	No	No	Yes	No	No	No	LBA
LS28	Laois	Cooflin	E2230	Poss.	No	No	Yes	Spread	Timber pathway and linear feature	No	MBA
LS29	Laois	Cooflin	E2231	Yes	No	No	No	No	No	No	MBA–EM
LS30	Laois	Corraun	E2236	Mult	Yes	No	Yes	Spread	Shell deposit	No	MBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
LS31	Laois	Corraun	E2237	Poss.	No	No	Yes	Spread	No	No	LN–EBA
LS32	Laois	Cross	E2424	Yes	No	No	Yes	Mound	No	No	LBA
LS33	Laois	Cuffsborough	E2185	Mult	No	Poss.	Yes	Spread	Wells, Slot–trench, Water-channel and burnt platform	No	MBA–LBA
LS34	Laois	Cuffsborough	E2198	Poss.	No	No	Yes	No	Wells and Poss. Water-channel	Yes	MBA–LBA
LS35a	Laois	Curragh	E2212	Poss.	No	No	Mult	Mound	Well and Stake-Holes	Yes	LBA–EIA
LS35b	Laois	Curragh	E2212	Yes	Yes	No	No	No	Stake-Holes	Yes	CL
LS35c	Laois	Curragh	E2212	No	No	No	No	Spread	No	No	
LS36	Laois	Curragh	E2249	Poss.	No	No	Mult	Spread	No	No	CL
LS37	Laois	Friarsland	E2240	No	No	No	No	Spread	No	No	
LS38	Laois	Gortnagroagh	E2189	Yes	No	No	Yes	No	Water-channel and cistern	Yes	LBA
LS39	Laois	Leap	E2131	No	No	No	No	Spread	No	No	EBA
LS40a	Laois	Oldglass	E2216	Yes	No	No	No	Spread	No	No	EBA
LS40b	Laois	Oldglass	E2216	No	No	No	No	Spread	No	No	EBA
LS41a	Laois	Oldglass	E2217	Yes	No	No	No	Spread	No	No	MBA
LS41b	Laois	Oldglass	E2217	Yes	No	No	Yes	Spread	No	No	EBA
LS42	Laois	Shanboe	E2172	Mult	No	No	Yes	Mound	Curvilinear feature and well	Yes	MBA
LS43	Laois	Shanboe	E2175	Poss.	No	No	Yes	Spread	No	No	LBA
LS44	Laois	Shanboe	E2176	Yes	Yes	Yes	Yes	Mound	No	Yes	MBA–EM
LS45	Laois	Springfield	E2191	Poss.	No	No	Yes	No	No	No	MBA
LS46	Laois	Springfield	E2192	Yes	No	No	Mult	No	No	Yes	LN
LS47	Laois	Tintore	E2208	Yes	No	No	No	Yes	No	No	EBA–MBA
LS48	Laois	Tintore	E2208	Mult	Yes	Poss.	Mult	Spreads	Ditched enclosure	Yes	LBA
LM01	Leitrim	Drumsna	94E0158	Yes	Yes	No	No	Spread	No	No	EBA
LM02	Leitrim	Kildorragh	94E123	Yes	No	Yes	No	Mound	Date from structure	Yes	EM
LM03	Leitrim	Kiltycarney	94E097	Yes	No	No	Yes	Spread	No	Yes	EBA
LM04	Leitrim	Tully	94E041	Yes	Yes	No	No	Spread	No	Yes	BA?
LM05	Leitrim	Cloonturk	E3292	No	No	No	Yes	Spread	Modern pit	Yes	CL
LM06	Leitrim	Georgia	E3307	Yes	No	No	Yes	Spread	Stake-Holes	Yes	
LM07	Leitrim	Moher a–b	E3301	Yes	No	Poss.	No	Mound	Stake–structure, Poss. brushwood platform and working surface	Yes	EBA–LBA
LM08	Leitrim	Moher	E3305	No	No	No	No	Spread	No	Yes	LN
LM09	Leitrim	Aghamore	E3310	Mult	No	No	Mult	Spreads	No	Yes	
LM10	Leitrim	Aghnahunshin	E3311	Mult	No	No	Mult	Spread	Water-channels	Yes	CL
LM11	Leitrim	Clooncolry	E3295	Mult	No	No	Mult	Spread	No	Yes	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
LM12a	Leitrim	Errew	06E0473	Yes	No	Poss.	No	Spread	Clay Platform, Stake–line	No	EBA
LM12b	Leitrim	Errew	06E0473	Yes	No	No	No	Spread	Clay Platform	No	LBA
LM12c	Leitrim	Errew	06E0473	Yes	No	No	No	Spread	Clay Platform and Brushwood	No	
LM12d	Leitrim	Errew	06E0473	No	No	No	No	Spread	Clay Platform	No	LBA
LK01	Limerick	Raheen	E385	Yes	No	No	Yes	Mound	No	No	EBA
LK02	Limerick	Ballycahane Upper	Unknown	Yes	No	No	No	Mound	No	No	
LK03	Limerick	Cloghacloka	Unknown	Yes	No	No	No	Mound	No	No	Neo
LK04	Limerick	Ballycahane Lower	E395	No	No	No	No	Mound	No	No	Meso
LK05	Limerick	Ballylin	Unknown	Yes	No	No	No		No	No	EBA–MBA
LK06	Limerick	Attyflin	96E0379	No	No	No	Yes	Mound	Kerbing	No	
LK07	Limerick	Attyflin	96E0291	No	No	No	No	Mound	Revetment	No	
LK08	Limerick	Dooradoyle	97E0289	Yes	No	No	No	Mound	No	No	
LK09	Limerick	Cloghacloka	98E0159	Mult	Yes (3)	No	No	Mound	No	No	
LK10	Limerick	Attyflin	99E0171	Yes	No	No	Yes	Mound	Stake-Holes	No	
LK11	Limerick	Barnakyle	99E0067	Mult	Yes	No	No	Mound	Well (modern)	No	
LK12	Limerick	Derryknockane	99E0093	Yes	No	No	Yes	Spread	No	No	
LK13	Limerick	Rathbane South	99E0633	Yes	Poss.	No	Yes	Spread	Stake-Holes	No	
LK14	Limerick	Rathbane South	99E0634	Yes	No	No	Yes	Spread	Cistern and gully	Yes	
LK15	Limerick	Rossbrien	99E0524	No	No	No	No	Mound	No	Yes	
LK16	Limerick	Cappamore	00E0595	Yes	No	No	No	Mound	No	No	
LK17	Limerick	Rathbane South	00E0341	Yes	No	No	Mult	Mound	Stake-Holes	Yes	EBA
LK18a	Limerick	Drominycarra	00E0583	Yes	No	No	Yes	Spread	Gully	No	
LK18b	Limerick	Drominycarra	00E0583	Yes	No	No	No	Spread	No	Yes	
LK19	Limerick	Crabbsland	00E0852	No	No	No	Yes	Mound	Medieval furnaces	Yes	EBA
LK20	Limerick	Peafield	01E0484	Yes	No	No	No	Spread	No	No	EBA
LK21	Limerick	Hermitage	01E0319	Poss.	No	No	Yes	Spread	No	No	MBA–LBA
LK22	Limerick	Newtown	01E0406	Yes	Yes	No	No	Spread	Stake-Holes	No	
LK23	Limerick	Prospect	02E0142	Poss.	No	Yes	Yes	Spread	Post-Holes	No	
LK24	Limerick	Ballyvollane	02E1403	Poss.	No	No	Mult	Spread	No	Yes	
LK25	Limerick	Ballyvollane	02E1348	Poss.	No	No	Yes	Mound	No	No	
LK26	Limerick	Adamswood	02E1213	Yes	Yes	No	No	Spread	No	No	
LK27	Limerick	Adamswood	02E1214	Yes	No	No	Yes	Spreads	Stake-Holes	No	
LK28	Limerick	Adamswood	02E669	Yes	No	No	Mult	Mound	No	No	EBA
LK29	Limerick	Ballincurra	02E0505	Yes	No	No	Yes	Spreads	No	No	
LK30	Limerick	Ballincurra	02E0470	Yes	No	No	Yes	Spread	No	Yes	EBA
LK31	Limerick	Ballingarrane	02E0662	No	Poss.	No	No	Mound	No	No	
LK32	Limerick	Ballymackeamore	02E0526	Yes	No	No	Yes	Spreads	Stone surface	Yes	EBA–IA
LK33	Limerick	Ballymackeamore	02E0625	Yes	No	No	Yes	Spread	Medieval pit	Yes	EBA
LK34	Limerick	Ballymackeamore	02E0626	No	No	No	No	Spread	No	No	M
LK35	Limerick	Ballynacragga	02E0848	Yes	Yes	No	Yes	Mound	No	No	MBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
LK36	Limerick	Ballyveloge	02E1697	Yes	No	No	Yes	Spread	No	No	
LK37	Limerick	Castlemungret	02E1735	Poss.	No	No	Yes	Spread	No	No	
LK38	Limerick	Castlemungret	02E1735	Poss.	No	No	Yes	Spread	No	No	
LK39	Limerick	Clogh East	02E0657	Yes	Yes	Poss.	Yes	Spread	Post-holes	Yes	LBA
LK40	Limerick	Commons	02E0550	No	No	No	Yes	No	No	No	
LK41	Limerick	Commons	02E0656	Yes	No	No	Yes	Spread	No	No	
LK42	Limerick	Commons	02E0600	No	No	No	Yes	No	Gully	Yes	
LK43	Limerick	Dollas Upper	02E0476	Yes	No	No	No	Mound	Stone surface	No	EBA
LK44	Limerick	Finniterstown	02E0665	No	No	No	Yes	Destroyed	Poss. well	No	
LK45	Limerick	Inchagreenoge	02E0899	Yes	No	No	Yes	Mound	Spring and trackway	Yes	EBA
LK46	Limerick	Inchagreenoge	02E0899	Yes	No	No	No	Mound	Spring and trackway	Yes	EBA
LK47	Limerick	Inchinclare	02E0552	No	Poss.	No	Yes	No	No	No	LIA–EM
LK48	Limerick	Kilfinny	02E0559	Mult	No	No	Yes	Mound	No	No	
LK49	Limerick	Kilfinny	02E0581	Yes	No	No	No	Spread	No	Yes	EBA
LK50	Limerick	Knockuregare	02E0429	Yes	Yes	No	No	Spread	No	No	
LK51	Limerick	Leahys	02E0900	Poss.	No	No	No	Mound	No	No	LBA
LK52	Limerick	Leahys	02E0849	Mult	Mult	No	Yes	Mound	Revetment	No	MBA
LK53	Limerick	Milltown North	02E0643	Yes	No	No	No	Destroyed	Poss. water-channel	No	
LK54	Limerick	Robertstown	02E0832	No	No	No	No	Spread	No	No	
LK55	Limerick	Rincullia	02E0670	Yes	No	No	Mult	Mound	Stone trackway	No	
LK56	Limerick	Tullerboy	02E0500	No	No	No	Yes	Spread	No	Yes	
LK57	Limerick	Tullerboy	02E0514	Yes	No	No	Yes	No	No	Yes	
LK58a	Limerick	Kilbane	03E1717	Yes	No	No	Mult	Spread	No	No	
LK58b	Limerick	Kilbane	03E1717	No	No	No	No	Spread	No	No	
LK59	Limerick	Ballybrown	03E1603	Yes	No	No	No	Mound	No	No	
LK60	Limerick	Coonagh West	E2092	No	No	No	Yes	Mound	Cobbled surface	Yes	MBA–LBA
LK61	Limerick	Coonagh West	E2093	Yes	Yes	No	No	Mounds	Palaeochannel	Yes	CL–MBA
LK62	Limerick	Brackbaun	E2339	Yes	Yes	No	Yes	Mound	No	Yes	MBA
LK63	Limerick	Brackbaun	E2306	Yes	Yes	No	No	Mound	Stockpile and Stake-holes	No	IA
LK64	Limerick	Lisnagry	E2330	Yes	No	No	No	Mound	No	Yes	MBA
LK65a	Limerick	Richhill	E2329	Yes	Yes	No	Mult	Mound	Roasting pits, Stake-holes	Yes	LBA
LK65b	Limerick	Richhill	E2329	No	No	No	Mult	Mound	No	No	
LK65c	Limerick	Richhill	E2329	Yes	No	No	Mult	Mound	No	No	CL
LK66	Limerick	Sallymount	E2308	Yes	No	No	Yes	Spread	No	No	CL
LK67	Limerick	Gardenhill	E2321	Yes	No	Poss.	No	Mound	Stockpile	No	LBA
LK68	Limerick	Gortnalahagh	E2323	Mult	No	No	No	Mound	Modern well	No	MBA–LBA
LD01	Longford	Aghadegnan	93E0050	Yes	No	No	Yes	Spread	No	No	
LD02	Longford	Lisnamuck	03E1421	Yes	No	No	No	Spread	Stake-holes	No	
LD03a	Longford	Lisnamuck	03E1422	Yes	No	No	Yes	Mound	Well?	No	
LD03b	Longford	Lisnamuck	03E1422	No	No	No	Yes	Spread	No	No	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
LD03c	Longford	Lisnamuck	03E1422	Yes	No	No	Yes	Spread	No	No	
LD04	Longford	Aghareagh	09E316	No	No	No	No	Mound	No	No	
LH01	Louth	Dowdallshill	94E077	Poss.	No	No	Yes	Spread	No	Yes	
LH02	Louth	Carstown	98E043	Yes	Yes	No	No	Mound	Stake-Holes	Yes	
LH03	Louth	Castletown	98E0573	Yes	No	No	Yes	Spread	No	No	
LH04	Louth	Tattyboys	98E0573	Yes	No	No	Yes	Spread	No	No	
LH05	Louth	Cookstown	98E0573	Yes	No	No	No	Spread	No	No	
LH06	Louth	Cookstown	98E0573	No	No	No	No	Spread	No	No	
LH07	Louth	Braganstown	97E0475	Yes	Yes	No	Yes	Spread	No	Yes	
LH08	Louth	Harristown	99E0498	No	No	No	No	Mound	No	Yes	
LH09	Louth	Newrath	97E0475	Yes	Yes	No	Yes	Spread	No	No	
LH10	Louth	Richardstown	99E0465	Yes	No	No	No	Mound	No	No	
LH11	Louth	Coolfore	00E0795	No	No	No	No	Spread	Stake-Holes	No	
LH12	Louth	Crumlin	99E0430	Yes	Yes	No	Yes	Spread	No	Yes	
LH13	Louth	Crumlin	99E0430	Yes	No	No	Yes	Spread	No	No	
LH14	Louth	Hill of rath	00E0178	Yes	No	No	Yes	Mound	Water–channel	Yes	
LH15	Louth	Hill of rath	00E0942	No	No	No	No	Spread	No	No	
LH16	Louth	Mell	00E0942	Yes	No	No	Yes	Mound	No	No	
LH17	Louth	Mell	00E0945	Yes	No	No	Yes	Mound	No	Yes	
LH18	Louth	Newtown	00E0796	Yes	No	No	Yes	Mound	No	Yes	
LH19	Louth	Newtown	00E0796	Yes	Yes	No	Yes	Mound	Stake-Holes	Yes	
LH20	Louth	Farranderg	01E1009	Yes	No	No	Yes	Mound	No	Yes	
LH21	Louth	Mell	01E10067	No	No	No	No	Spread	No	Yes	
LH22	Louth	Littlemill	02E01753	No	No	No	Yes	Spread	No	No	EM
LH23	Louth	Faughart Lower	03E01397	Yes	Poss.	Yes	Yes	Mound	Platform?	No	LBA
LH24	Louth	Newtownbalregan	04E0817	Yes	No	No	Poss.	Spread	No	No	
LH25	Louth	Newtownbalregan	03E0114	Yes	No	No	No	Spread	Well	Yes	LBA
LH26	Louth	Proleek	E3795	Poss.	No	No	Mult	Spread	Well	Yes	
LH27	Louth	Haggardstown	04E0876	Poss.	Poss.	No	Yes	Spread	Stake-Holes and Poss. oven	No	
LH28	Louth	Dungooly	06E0879	Yes	No	No	No	Mound	No	No	
MO01	Mayo	Bofeenaun	92E141	Yes	Poss.	Poss.	No	Mound	Poss. windbreak	No	LBA
MO02a	Mayo	Glen	92E163	No	Poss.	No	No	Mound	No	Yes	LBA
MO02b	Mayo	Glen	92E163	No	Poss.	No	No	Mound	No	Yes	LBA
MO03	Mayo	Lecarrow	92E162	Yes	Yes	No	Yes	Mound	revetment, stone surface and pit oven	Yes	EBA
MO04	Mayo	Lecarrow	94E156	Yes	No	No	No	Mound	stone stockpile	No	EBA
MO05	Mayo	Rathkelly	94E156	No	Yes	No	Yes	Mound	No	Yes	
MO06	Mayo	Ballinrobe Demesne	94E017	No	No	No	No	Spread	No	No	CL
MO07	Mayo	Ballinrobe Demesne	94E017	No	No	No	No	Mound	No	Yes	EBA
MO08	Mayo	Ballinrobe Demesne	94E017	No	No	No	No	Mound	No	No	
MO09	Mayo	Ballinrobe Demesne	94E017	No	No	No	No	Mound	No	No	
MO10	Mayo	Ballinrobe Demesne	94E017	No	No	No	No	Spread	No	Yes	
MO11	Mayo	Coolavally	96E110	Yes	No	No	No	Mound	No	Yes	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
MO12	Mayo	Coolroe	98E0389	Yes	Poss.	No	Yes	Mound	Stakes	Yes	CL
MO13	Mayo	Coolroe	98E0389	Yes	No	No	Mult	Mound	channel	Yes	MBA
MO14	Mayo	Coolroe	98E0389	Yes	No	No	No	Mound	No	Yes	EBA
MO15	Mayo	Clare	98E0412	Yes	No	No	Yes	Mound	Platform and working surface	Yes	
MO16	Mayo	Deerpark East	01E0562	Yes	No	No	Yes	Spread	No	No	EBA
MO17	Mayo	Deerpark East	01E0562	Yes	Poss.	No	No	Mound	No	No	LN
MO18	Mayo	Deerpark East	01E0562	Yes	No	No	No	Spread	No	No	EBA
MO19	Mayo	Deerpark East	01E0562	No	No	No	No	Spread	No	No	MBA
MO20	Mayo	Deerpark East	01E0563	Yes	No	No	No	Mound	Timber walkway	Yes	EBA
MO21	Mayo	Deerpark East	01E0563	No	No	No	No	Spread	No	No	
MO22	Mayo	Deerpark East	01E0563	Yes	No	No	No	Spread	No	No	LBA
MO23	Mayo	Attireesh	01E0649	Yes	Poss.	No	No	Mound	No	Yes	LBA
MO24	Mayo	Attireesh	01E0649	Yes	No	No	No	Mound	Togher and shoreline/ fording point?	Yes	MBA–LBA
MO25	Mayo	Attireesh	01E0649	Yes	No	No	No	Mound	No	No	EBA
MO26	Mayo	Attireesh	01E0649	Poss.	No	No	No	Mound	No	No	EBA
MO27	Mayo	Gortaroe	01E0649	Yes	No	No	Yes	Spread	Trackway	No	LN
MO28	Mayo	Gortaroe	01E0649	Poss.	No	No	No	Spread	Ancient lake floor	No	LN
MO29	Mayo	Gortaroe	01E0649	Yes	No	No	No	Mound	Shoreline and mound revetment	Yes	MBA
MO30	Mayo	Gortaroe	01E0649	Yes	No	No	No	Spread	No	No	CL
MO31	Mayo	Gortaroe	01E0649	Yes	No	No	No	Mound	No	No	CL
MO32	Mayo	Bekan	01E0679	Yes	No	No	No	Spread	No	Yes	
MO33a	Mayo	Carrowcor	01E0680	No	No	No	No	Spread	No	Yes	
MO33b	Mayo	Carrowcor	01E0680	No	No	No	No	Spread	No	Yes	
MO34a	Mayo	Cloonbulban	01E0680	Yes	No	No	No	Spread	Water-channels	Yes	
MO34b	Mayo	Cloonbulban	01E0680	Yes	No	No	No	Spread	No	No	
MO35a	Mayo	Fallakeeran	01E0966	No	No	No	No	Spread	No	Yes	
MO35b	Mayo	Fallakeeran	01E0966	No	No	No	No	Spread	No	No	
MO36	Mayo	Derragh	01E0315	Yes	No	No	No	Mound	No	No	
MO37	Mayo	Cloondace	01E0493	Yes	No	No	No	Spread	worked wood deposit	No	
MO38	Mayo	Devlis	02E1777	Yes	No	No	No	Spread	No	No	
MO39	Mayo	Derrinumera	03E1209	No	No	No	Mult	Spread	No	Yes	
MO40	Mayo	Carrowntreila	03E802	Yes	Yes	Mult	Yes	Mound	Well, Stake-Holes	No	EBA
MO41	Mayo	Ballyglass West	04E1507	No	No	No	No	Mound	No	Yes	EN
MO42	Mayo	Skiddernagh	05E0873	No	No	Poss.	No	Mound	Stakes	No	LN–MED
MO43	Mayo	Carrowmore	05E0739	Yes	No	No	Yes	Mound	No	No	MBA
MO44	Mayo	Grallagh	05E0740	Yes	No	No	Mult	Mound	No	Yes	LBA
MO45a	Mayo	Smuttanagh	05E0872	Mult	No	No	No	Spread	No	No	BA?
MO45b	Mayo	Smuttanagh	05E0872	Mult	Poss.	No	No	Spread	Poss. trough channels	No	LN

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
MO46	Mayo	Polldrain	05E0738	Yes	No	No	Yes	Mound	Stake-Holes	No	EBA
MO47	Mayo	Sonnagh	E3340	Yes	No	No	No	Mound	Platform/ trough base and worked wood deposit	No	LBA–IA
MO48a	Mayo	Sonnagh	E3344	Yes	No	No	No	Mound	No	No	MBA
MO48b	Mayo	Sonnagh	E3344	No	No	No	Mult	Spread	No	Yes	MBA–LBA
MO49	Mayo	Sonnagh	E3345	Yes	No	No	No	Mound	No	No	LN
MO50	Mayo	Sonnagh	E3346	Yes	No	No	No	Mound	Wood deposit	Yes	MBA
MO51	Mayo	Sonnagh	E3358	Yes	No	No	No	Mound	No	Yes	EBA
MO52	Mayo	Sonnagh	E3347	Yes	No	No	No	Mound	Brushwood deposit	Yes	MBA
MO53	Mayo	Sonnagh	E3348	No	No	No	No	Spread	No	No	EBA
MO54	Mayo	Sonnagh	E3349	No	No	No	No	Spread	No	No	MBA
MO55	Mayo	Sonnagh	E3526	No	No	No	Mult	Spread	No	Yes	EM
MO56	Mayo	Sonnagh	E3359	Yes	No	Poss.	No	Mound	Stakes/ windbreak?	No	MBA
MO57	Mayo	Tomboholla	E3350	No	No	No	No	Mound	No	No	LN
MO58	Mayo	Fauleens	E3353	Yes	No	Poss.	No	Mound	Stakes	Yes	EBA–LBA
MO59	Mayo	Fauleens	E3353	Yes	Poss.	No	No	Mound	Stakes	No	LBA
MO60	Mayo	Fauleens	E3352	No	No	No	No	Spread	No	No	EBA
MO61	Mayo	Fauleens	E3390	Yes	No	No	No	Spread	No	No	MBA–LBA
MO62	Mayo	CasheldufF	E3343	Yes	No	No	No	Mound	No	No	LBA
MO63	Mayo	Cloonaghboy	E3334	No	No	No	No	Spread	No	No	EM
MO64	Mayo	Cloonaghboy	E3357	Yes	No	No	No	Mound	Wood deposit	No	LBA
MO65	Mayo	Cloonaghboy	E3357	Yes	No	No	Yes	Mound	No	No	EBA
MO66	Mayo	Cloonfane	E3407	No	No	No	No	Spread	No	No	EBA
MO67	Mayo	Cloonfane	E3388	No	No	No	No	Spread	No	No	MED
MO68	Mayo	Cloonfane	E3412	No	No	No	No	Spread	No	No	EM
MO69	Mayo	Cloonmeen West	E3351	Yes	Poss.	No	Yes	Mound	Post–hole	No	MBA–LBA
MO70	Mayo	Cranmore	E3410	Yes	No	No	No	Spread	No	No	EBA–MBA
MO71	Mayo	Cranmore	E3433	Yes	No	No	No	Mound	No	No	MBA
MO72	Mayo	Mullenmadoge	E3337	Yes	No	No	No	Spread	No	No	LBA
MO73	Mayo	Mullenmadoge	E3339	Yes	No	No	No	Spread	Stakes	No	LBA
MO74	Mayo	Balla	08E0584	Yes	No	No	Yes	Mound	No	No	
MH01a	Meath	Sheephouse	95E973	Yes	No	No	No	Mound	No	Yes	EBA
MH01b	Meath	Sheephouse	95E973	Yes	No	No	Mult	Mound	No	Yes	MBA
MH02	Meath	Gormanstown	96E276	No	No	No	Yes	Mound	No	Yes	
MH03	Meath	Sarsfieldstown	01E0041	Yes	No	No	Mult	Spread	No	No	LBA
vMH04	Meath	Lisdornan	01E0415	Yes	No	No	Mult	Mound	No	Yes	EBA
MH05	Meath	Moorechurch	01E0385	Yes	No	No	Mult	Mound	External pit cluster	No	NL
MH06	Meath	Claristown	01E0038	Mult	No	No	Mult	Mound	Stake-Holes and water–channels	Yes	LN

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
MH07	Meath	Johnstown	01E0561	Yes	No	No	Yes	No	No	No	
MH08	Meath	Rathmullan	02E1245	No	No	No	Yes	No	No	No	MBA
MH09	Meath	Rossan	02E0866	Yes	No	No	No	No	No	Yes	LBA
MH10	Meath	Towlaght	02E1145	No	No	No	No	Spread	Poss. revetment	No	
MH11a	Meath	Arodstown	02E0687	Yes	No	No	No	Spread	No	No	EBA
MH11b	Meath	Arodstown	02E0687	No	No	No	No	Spread	No	No	
MH12	Meath	Arodstown	02E0688	Yes	No	No	Yes	Spread	No	No	EBA
MH13	Meath	Cloncowan	02E0833	Yes	No	No	Yes	Spread	Stake-holes	No	EBA
MH14	Meath	Clonymeath	02E0689	Yes	No	No	Yes	Mound	Cistern	Yes	EBA
MH15	Meath	Cooksland	02E0641	Yes	No	No	Mult	Spread	Stake-holes	Yes	CL
MH16	Meath	Knockmark	02E0633	No	No	No	No	Mound	No	Yes	
MH17	Meath	Lagore Little	02E0691	Yes	No	No	No	Mound	No	No	
MH18	Meath	Lagore Little	02E0692	No	No	No	Yes	Spread	No	No	
MH19	Meath	Ballynamona	03E0622	Yes	No	No	Yes	Spread	No	No	
MH20	Meath	Athboy Road	03E0169	Poss.	No	No	Mult	Spread	No	Yes	
MH21	Meath	Carranstown	03E0465	Mult	No	Yes	Yes	Mound	Poss. well	No	
MH22	Meath	Fleenstown Little	03E1355	No	No	No	No	Spread	No	No	
MH23a	Meath	Baltrasna	03E1361	Yes	No	No	Yes	Spread	No	Yes	EBA
MH23B	Meath	Baltrasna	03E1361	Yes	Yes	No	No	Spread	No	No	
MH24	Meath	Harlockstown	03E1310	Mult	No	No	No	Mound	No	Yes	EBA
MH25	Meath	Harlockstown	03E1237	Poss.	No	No	Poss.	Spread	No	No	
MH26	Meath	Rath	03E1314	Yes	No	Mult	Mult	Spread	Stake-holes, Wells and channels	Yes	
MH27	Meath	Causetown	04E0826	Poss.	No	No	Yes	Mound	No	No	
MH28	Meath	Drumbaragh	04E0826	Yes	No	No	Yes	Mound	Water–channel and Poss. oven	No	
MH29	Meath	Rathmullan	04E1212	Yes	No	No	No	Spread	No	Yes	
MH30	Meath	Carranstown	05E01342	Yes	No	No	No	Mound	No	Yes	EBA
MH31a	Meath	Ballinter	04E1462	Yes	No	No	No	Spread	Timber Stockpile?	No	LN–EBA
MH31b	Meath	Ballinter	04E1462	Yes	No	No	No	Spread	No	No	LN
MH31c	Meath	Ballinter	04E1462	Yes	Yes	No	No	Mound	No	No	EBA
MH32	Meath	Balgeeth	05E0022	Yes	No	No	No	Mound	Poss. revetment	No	EBA
MH33a	Meath	Balreask	05E0077	Yes	No	No	Yes	Spread	No	No	
MH33b	Meath	Balreask	05E0077	Yes	No	No	Mult	Spread	No	No	CL–EBA
MH33c	Meath	Balreask	05E0077	No	No	No	No	Spread	No	No	EM
MH34	Meath	Warrenstown	05E0429	Yes	No	No	No	Mound	No	No	LBA
MH35	Meath	Kilmessan	05E0075	No	No	No	No	Mound	Stake-holes	No	LBA
MH36	Meath	Kilmessan	05E0689	No	No	No	No	Spread	No	No	EBA
MH37	Meath	Killeen	05E0691	No	No	No	No	Spread	No	No	EBA
MH38	Meath	Athronan	05E0690	Yes	No	No	Mult	Spread	Cisterns? And large medieval pit	Yes	EBA
MH39	Meath	Athronan	04E1499	Yes	No	No	No	Spread	No	No	EBA
MH40	Meath	Leshemstown	04E1499	No	No	No	Yes	No	No	No	

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MH41	Meath	Leshemstown	05E0398	Yes	No	Poss.	Yes	Mound	Stake-holes and burial	Yes	EBA
MH42	Meath	Randalstown	04E1351	Yes	No	No	Yes	Mound	No	Yes	EBA
MH43	Meath	Bracetown	E3028	Yes	No	No	Yes	Mound	No	Yes	EBA–LBA
MH44	Meath	Ballinter	E3084	No	No	No	Yes	Spread	No	No	LN
MH45	Meath	Cooksland	E3058	Yes	No	No	Yes	Spread	No	Yes	EBA
MH46	Meath	Boyerstown	E3106	Poss.	No	No	Yes	Spread	Well	No	LBA
MH47	Meath	Boyerstown	E3109	Yes	No	No	Yes	Mound	No	No	EBA
MH48	Meath	Boyerstown	E3112	Poss.	No	No	Yes	Mound	Water–channel	No	EBA
MH49	Meath	Boyerstown	E3110	Yes	No	No	Mult	Spread	Enclosing ditch	No	LN
MH50	Meath	Roestown	E3054	Yes	No	No	Yes	Spread	Well and Stake-Holes	Yes	CL
MH51	Meath	Blundelstown	E3076	Yes	No	No	Yes	Spread	No	Yes	LN
MH52a	Meath	Boolies	E3167	Yes	No	No	Yes	Mound	No	No	LBA
MH52b	Meath	Boolies	E3167	Yes	No	No	Yes	Mound	No	No	
MH53	Meath	Boolies	E3166	Yes	No	No	Mult	Mound	No	No	EBA
MH54a	Meath	Chapelbride	E3168	Mult	No	No	No	Spread	Linear feature	No	MBA
MH54b	Meath	Chapelbride	E3168	No	No	No	Mult	No	No	No	
MH54c	Meath	Chapelbride	E3168	No	No	No	Yes	No	No	No	CL–EBA
MH55	Meath	Drumbaragh	E3173	Yes	No	No	No	Mound	No	Yes	EBA
MH56	Meath	Castlekeeran	E3176	Yes	No	No	Yes	Mound	No	No	EBA–IA
MH57a	Meath	Calliagstown	E3165	Yes	No	No	Yes	Mound	No	No	LBA
MH57b	Meath	Calliagstown	E3165	Yes	No	No	Yes	Mound	No	No	LBA
MH58	Meath	Pottlebane	E3179	Yes	No	No	Mult	Mound	Iron Age kiln	Yes	NL
MH59	Meath	Philpotstown	E3009	Yes	No	Yes	Yes	No	Well, structure and ditch	Yes	MBA
MH60	Meath	Philpotstown	E3081	No	No	No	Poss.	Mound	Site destroyed	No	
MH61	Meath	Derver	E3184	No	No	Yes	Mult	Spread	IA structure	No	IA–EM
MH62	Meath	Derver	E3185	No	No	No	Mult	Spread	No	No	EBA–IA
MH63	Meath	Ardbraccan	E3115	Yes	Yes	No	Yes	Mound	Cobbled surface and wells	Yes	BA*
MH64	Meath	Ardbraccan	E3116	Yes	Yes	No	Mult	Mound	Cobbled surface	Yes	
MH65	Meath	Ardbraccan	E3117	Yes	No	No	Yes	Spread	No	Yes	
MH66	Meath	Drumree	E3049	Yes	Yes	No	Mult	Spread	Cremation pit, Post-Holes, roasting pit	Yes	EBA
MH67	Meath	Berrilstown	E3063	No	No	No	Mult	No	No	Yes	EBA
MH68	Meath	Leshamstown	E3047	Yes	No	No	Mult	Mound	Cobbled surface	Yes	EBA
MH69	Meath	Leshamstown	E3048	No	No	No	Yes	No	No	No	
MH70	Meath	Williamstown or Bawn	E3097	Poss.	No	No	Mult	Mound	No	Yes	CL
MH71a	Meath	Williamstown or Bawn	E3098	Yes	No	No	Yes	No	Well and stockpile	Yes	MBA
MH71b	Meath	Williamstown or Bawn	E3098	No	No	No	Yes	No	No	No	CL
MH72	Meath	Bennettstown	E3025	No	No	No	Mult	Mound	Post-Holes	Yes	MBA

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MH73	Meath	Bennettstown	E3026	No	No	No	Yes	Spread	No	No	CL
MH74	Meath	Johnstown	E3041	Yes	No	No	Yes	Spread	Well and Stake-Holes	Yes	MBA–LBA
MH75a	Meath	Gainstown	E3101	No	No	No	Mult	Spread	No	Yes	EBA
MH75b	Meath	Gainstown	E3101	No	No	No	Mult	Spread	No	Yes	LN
MH76	Meath	Gainstown	E3102	No	No	No	Mult	Spread	No	Yes	CL–EBA
MH77a	Meath	Kennastown	E3093	Yes	No	No	Mult	No	Wells and Water-channels	No	LBA
MH77b	Meath	Kennastown	E3093	No	No	No	No	Spread	No	No	LN
MH77c	Meath	Kennastown	E3093	Mult	No	No	No	Mound	No	No	CL
MH77d	Meath	Kennastown	E3093	No	No	No	Mult	Spread	No	No	CL
MH77e	Meath	Kennastown	E3093	No	No	No	Yes	Spread	Well?	No	EBA
MH78	Meath	Kennastown	E3095	No	No	No	Mult	Mound	No	No	CL
MH79	Meath	Knocks	E3044	Mult	No	No	Mult	Spread	Enclosing ditch, stake-holes	No	EBA–LBA
MH80	Meath	Raynestown	E3039	Poss.	No	No	Mult	No	Mound removed	Yes	EBA
MH81a	Meath	Townparks	E3114	Yes	No	No	Yes	Mound	Stake-holes	Yes	EBA
MH81b	Meath	Townparks	E3114	Poss.	No	No	Mult	Spread	Stake-holes and Water-channels	No	CL
MH82	Meath	Clowanstown	E3064	Mult	No	No	Mult	Mounds	Wooden Vessels	Yes	NL
MH83a	Meath	Clowanstown	E3065	No	No	No	Yes	Spread	No	Yes	CL
MH83b	Meath	Clowanstown	E3065	No	Yes	No	No	No	No	Yes	NL
MH83c	Meath	Clowanstown	E3065	Yes	No	No	Yes	Spread	No	Yes	EBA
MH84	Meath	Ardbraccan	E3120	Yes	No	No	Yes	Mound	No	No	
MH85	Meath	Ballybeg	E3132	Yes	No	No	No	Mound	No	No	
MH86	Meath	Cookstown Great	E3138	Yes	Yes	No	Mult	Mound	Well	Yes	
MH87a	Meath	Cookstown	E3139	Yes	No	No	Mult	Spread	Wells	No	
MH87b	Meath	Cookstown	E3139	No	No	Poss.	Yes	Spread	No	No	
MH88	Meath	Newrath Little	E3153	Yes	No	No	Yes	Spread	Water-channel	No	
MH89	Meath	Newrath Little	E3154	Yes	No	No	No	Spread	Water-channel	No	
MH90	Meath	Nugentstown	E3135	No	No	No	No	Spread	No	No	
MH91	Meath	Phoenixtown	E3128	Yes	No	Poss.	Yes	Mound	Post-Holes	Yes	
MH92	Meath	Phoenixtown	E3127	Yes	No	No	No	Spread	No	Yes	
MH93	Meath	Townparks	E3150	No	No	No	No	Spread	No	No	
MN01	Monnaghan	Dromore West	03E0481	Yes	No	No	Yes	Spreads	No	No	
MN02	Monnaghan	Monanny	03E0888	Yes	No	No	No	Mound	No	No	EBA–MBA
MN03	Monnaghan	Monanny	03E1254	Yes	Yes	No	Yes	Mound	Post-Holes and stakes	Yes	MBA–LBA
MN04	Monnaghan	Annahagh	04E1161	Yes	No	No	No	Spread	No	Yes	MBA
MN05	Monnaghan	Annahagh	04E1160	Yes	No	No	Yes	Mound	No	Yes	EBA
MN06	Monnaghan	Tullyhirm	04E1159	Yes	No	No	No	Mound	No	No	EBA
MN07	Monnaghan	Cloghvally Upper	04E1115	No	No	No	No	Spread	No	No	EBA–MBA
OY01	Offaly	Cloghjordan Road	04E1359	No	Poss.	No	Yes	Spreads	No	No	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
OY02	Offaly	Banagher	06E0301	No	No	No	No	Spread	No	Yes	
OY03	Offaly	Puttaghan	E2493	No	Poss.	No	No	Spread	No	No	
OY04	Offaly	Ardan	E2847	Mult	No	No	Yes	Spread	Well/spring	Yes	MBA
OY05	Offaly	Ardan	E2846	Mult	Yes	No	Yes	Spread	No	Yes	EBA
OY06	Offaly	Burrow or Glennanummer	E2678	Yes	No	No	Yes	Spread	No	No	MBA
OY07	Offaly	Burrow or Glennanummer	E2679	Yes	No	No	No	Mound	Platform	No	MBA–LBA
OY08a	Offaly	Burrow or Glennanummer	E2680	Mult	No	Yes	Yes	Mound	Water-channel and Poss. sweatlodge	Yes	MBA–LBA
OY08b	Offaly	Burrow or Glennanummer	E2680	No	No	No	Yes	No	No	No	EBA
OY09	Offaly	Russagh	E2683	Yes	No	No	No	Spread	No	Yes	LBA
OY10	Offaly	Russagh	E2684	Yes	No	No	Yes	Spread	No	No	LBA
OY11	Offaly	Culleenwaine	E3741	Mult	Yes	No	Mult	Mounds	Stake-Holes	Yes	EBA
RM01	Roscommon	Tintagh	96E117	Mult	No	No	Yes	Mound	No	No	
RM02	Roscommon	Erris	96E050	No	No	No	No	Mound	Trackway	No	
RM03	Roscommon	Hughestown	99E0401	Yes	No	Poss.	No	Mound	Stake-Holes, stone surface/ platform	No	EBA
RM04	Roscommon	Cloongownagh	99E0193	Yes	Yes	No	No	Mound	No	No	LIA
RM05	Roscommon	Cloongownagh	03E1771	No	No	No	No	Spread	No	Yes	
RM06	Roscommon	Cloongownagh	03E1841	No	No	No	No	Spread	No	No	MBA
RM07	Roscommon	Gortlustia	01E0906	Yes	No	No	No	Spread	No	No	
RM08	Roscommon	Clooneybeirne	01E0906	Yes	Poss.	No	No	Spread	No	No	
RM09	Roscommon	Currinah	E3356	Yes	No	No	No	Mound	Revetment	No	LBA
RM10	Roscommon	Currinah	E3356	Yes	No	No	No	Mound	Stone Platform	No	MBA–LBA
RM11	Roscommon	Currinah	E3355	Yes	No	No	No	Mound	No	No	MBA–LBA
RM12	Roscommon	Kilbegly	E3369	Yes	No	No	No	Mound	No	No	EBA
RM13	Roscommon	Ardagawna	E3269	Yes	No	No	No	Spread	Stake-Holes	Yes	EIA
RM14	Roscommon	Culiaghmore	E3268	Mult	No	No	No	Spread	No	No	EBA
RM15a	Roscommon	Taduff East	E3271	Yes	Yes (2)	No	No	Spread	No	No	
RM15b	Roscommon	Taduff East	E3271	Yes	No	No	Yes	Spread	Stake-Holes	No	EBA–IA
RM16	Roscommon	Banda	10E0302	Yes	No	No	No	Mound	Water-channel	No	EBA
RM17	Roscommon	Bockagh	10E0300	Yes	No	No	No	Mound	No	No	MBA–LBA
RM18	Roscommon	Bockagh	10E0377	Yes	No	No	No	Mound	No	No	EBA
RM19a	Roscommon	Bockagh	10E0378	Yes	No	No	No	Spread	No	No	
RM19b	Roscommon	Bockagh	10E0378	Yes	No	No	No	Spread	No	No	MBA–LBA
RM19c	Roscommon	Bockagh	10E0378	No	No	No	No	Mound	No	No	
RM20a	Roscommon	Bockagh	10E0379	Yes	No	No	Yes	Mound	No	No	EBA–LBA
RM20b	Roscommon	Bockagh	10E0379	Yes	No	No	No	Spread	No	No	
RM20c	Roscommon	Bockagh	10E0379	Yes	No	No	No	Mound	No	No	LBA
RM21	Roscommon	Keelbanada	10E0303	No	No	No	No	Spread	No	No	EBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
RM22	Roscommon	Keelbanada	10E0304	Yes	No	No	Yes	Spread	No	No	EBA
RM23	Roscommon	Toolbracken	10E0301	Yes	No	No	No	Spread	No	No	LBA
SO01	Sligo	Ballaghboy	95E210	Yes	No	No	No	Spread	No	No	
SO02	Sligo	Ballaghboy	95E210	Yes	No	No	No	Spread	Post-holes	No	
SO03	Sligo	Ballinafad	95E164	Yes	No	No	No	Spread	No	No	
SO04	Sligo	Knoxspark	00E0268	Yes	No	Poss.	No	Mound	Stake revetment/ enclosure/ structure	No	
SO05a	Sligo	Ballinacar	00E0307	Yes	No	No	Mult	Spread	Ditch	No	EBA
SO05b	Sligo	Ballinacar	00E0307	Yes	No	No	No	Spread	No	No	
SO05c	Sligo	Ballinacar	00E0307	No	No	No	No	Spread	No	No	
SO06	Sligo	Caltragh	00E0859	No	No	No	No	Mound	Stone setting on mound	Yes	MBA
SO07	Sligo	Caltragh	00E0819	No	No	No	No	Mound	Neolithic wall (revetment feature).	Yes	MBA
SO08	Sligo	Magheraboy	00E0833	No	No	No	No	Mound	No	No	
SO09	Sligo	Caltragh	01E0395	No	Yes	No	No	Mound	Neolithic wall (revetment feature)	Yes	EBA
SO10	Sligo	Caltragh	01E0395	No	No	No	No	Mound	Neolithic wall (revetment feature)	No	EBA
SO11	Sligo	Caltragh	01E0395	No	No	No	No	Spread	No	No	
SO12	Sligo	Keelty	02E0805	Poss.	No	No	No	Mound	No	No	
SO13	Sligo	Cummeen	02E0852	Poss.	No	No	Yes	Spread	No	No	
SO14	Sligo	Caltragh	03E0542	Yes	No	Yes	Yes	Spread	Settlement and cremation burials	No	EBA–MBA
SO15	Sligo	Caltragh	03E0542	Yes	No	No	No	Mound	Water-channel	No	MBA
SO16a	Sligo	Caltragh	03E0543	Yes	No	No	Yes	Mound	Water-channel, Stake-holes	No	LBA
SO16b	Sligo	Caltragh	03E0543	No	No	No	No	Spread	No	No	
SO16c	Sligo	Caltragh	03E0543	No	No	No	No	Spread	No	No	
SO17	Sligo	Magheraboy	03E0547	Mult	No	No	Mult	Spread	Water-channels	Yes	LN–EBA
SO18	Sligo	Magheraboy	03E0547	Mult	Poss.	No	Yes	Spread	Stake-holes	Yes	EBA–LBA
SO19a	Sligo	Tonafortes	03E0535	Poss.	No	No	No	Spread	No	Yes	
SO19b	Sligo	Tonafortes	03E0535	Yes	No	No	Yes	Spread	Stake-holes	Yes	EBA
SO20	Sligo	Tonafortes	03E1414	No	No	No	No	Spread	No	No	
SO21	Sligo	Drumaskibbole	03E1041	Mult	No	No	No	Mound	Later walls	No	
SO22	Sligo	Ballyglass	08E0809	Yes	No	No	No	Mound	No	Yes	
TY01	Tipperary	Derryfadda	96E202	Yes	Poss.	No	No	Spread	Trackway	Yes	MBA
TY02	Tipperary	Killoran	96E298	Yes	Yes		No	Mound	Trackway and Spring	No	EBA
TY03	Tipperary	Killoran	97E158	Yes (	Poss.	No	Yes	Mound	No	No	MBA
TY04	Tipperary	Killoran	97E158	Yes	Yes	No	No	Spread	Timber and stone platform.	No	LBA
TY05	Tipperary	Killoran	97E158	Yes	No	No	No	Spread	Platform	No	MBA–LBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
TY06	Tipperary	Killoran	97E372	Yes	No	No	No	Mound	No	No	
TY07	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	Yes	
TY08	Tipperary	Killoran	97E372	Yes	Yes	No	No	Spread	Stake-Hole west of trough	No	MBA
TY09	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	No	
TY10	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	No	CL
TY11	Tipperary	Killoran	97E372	Mult	No	No	Yes	Spread	Poss. well	No	
TY12	Tipperary	Killoran	97E372	Yes	No	No	Yes	Spread	Linear Feature	No	
TY13	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	No	
TY14	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	No	
TY15	Tipperary	Killoran	97E372	Yes	No	No	No	Spread	No	No	LBA
TY16	Tipperary	Killoran	97E372	Yes	No	No	Yes	Spread	Poss. well	No	LBA
TY17	Tipperary	Killoran	97E372	Yes	Poss.	No	No	Destroyed	No	No	BA
TY18	Tipperary	Killoran	97E372	Yes	No	No	Yes	Destroyed	No	No	BA
TY19	Tipperary	Knockaunkennedy	98E0472	Yes	Yes	No	Mult	Mound	Cobbled surface	Yes	MBA–EM
TY20	Tipperary	Lahesseragh	98E0475	No	No	No	Yes	Mound	Poss. revetment	No	LBA
TY21	Tipperary	Drummin	00EE0210	Poss.	No	No	Yes	Mound	No	No	
TY22	Tipperary	Coolaholloga	00E0211	Poss.	No	No	Mult	Mound	No	No	EBA
TY23	Tipperary	Richmond	00E0215	Yes	Poss.	No	Mult	Spread	No	Yes	MED
TY24a	Tipperary	Richmond/ Gortlandroe	00E0217/8	Mult	Yes	No	Mult	Mound	Water-channel	No	
TY24b	Tipperary	Richmond/ Gortlandroe	00E0217/8	Yes	No	No	No	Mound	No	Yes	LBA
TY24c	Tipperary	Richmond/ Gortlandroe	00E0217/8	Yes	No	Poss.	No	Spread	Post-holes	No	EBA
TY24d	Tipperary	Richmond/ Gortlandroe	00E0217/8	Yes	Yes	Poss.	Yes	Mound	Post-holes	No	
TY25	Tipperary	Solsborough	00E0221	Yes	No	No	Yes	Spread	No	No	LBA
TY26	Tipperary	Grallagh	00E0227	No	No	No	Yes	Spread	No	No	
TY27a	Tipperary	Tullaheedy	00E0222	Poss.	No	No	Mult	Mound	No	Yes	CL
TY27b	Tipperary	Tullaheedy	00E0222	Poss.	No	Poss.	Mult	Mound	No	Yes	EBA
TY28	Tipperary	Raheen	E2295	Yes	Yes	Yes	Mult	Mound	Water cisterns and stake-holes	No	MBA
TY29	Tipperary	Lissava	E2296	Yes	No	No	Yes	Mound	Stake-holes	No	MBA
TY30	Tipperary	Lissava	E2296	Yes	No	No	Yes	No	Stake-holes	No	EBA
TY31	Tipperary	Lissava	E2296	Yes	No	No	Yes	Mound	Post-hole	No	EBA
TY32	Tipperary	Lissava	E2296	Poss.	Yes	No	Yes	Spread	Water-channel, and Poss. slot-trench	No	
TY33	Tipperary	Lissava	E2296	Yes	Yes	No	No	Mound	No	No	MBA
TY34	Tipperary	Clonmore North	E2294	Yes	No	Yes	Yes	Spread	Stake and Post-Holes	Yes	MBA
TY35	Tipperary	Coolderry	E2317	Yes	No	No	No	Mound	No	Yes	LN–CL
TY36	Tipperary	Coolderry	E2318	Mult	No	No	Mult	Spread	No	No	CL
TY37	Tipperary	Ballyard	E2310	Yes	No	No	Yes	Mound	Cobbled surface	No	LBA–IA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
TY38	Tipperary	Lackenavea	E2486	No	No	No	Yes	Spread	Cobbled surface	No	LBA
TY39a	Tipperary	Gortybrigane	E2487	Yes	No	No	No	Mound	No	No	MBA
TY39b	Tipperary	Gortybrigane	E2487	No	No	No	Yes	Spread	Post-hole and Roasting pit	No	MBA
TY40	Tipperary	Gortybrigane	E2488	No	No	No	No	Mound	No	No	LBA
TY41a	Tipperary	Gortybrigane	E3428	Yes	No	No	No	Mound	No	No	EBA
TY41b	Tipperary	Gortybrigane	E3428	No	No	No	No	Spread	No	No	
TY42	Tipperary	Cooleen	E2315	Yes	No	No	Yes	Spread	Post-hole	No	CL–EBA
TY43a	Tipperary	Annaholty	E3326	Yes	No	No	No	Mound	Well	Yes	
TY43b	Tipperary	Annaholty	E3326	Yes	No	No	No	Mound	No	Yes	
TY44	Tipperary	Annaholty	E2313	Yes	No	No	Mult	Mound	Stake-holes	No	BA*
TY45	Tipperary	Annaholty	E2314	Yes	No	No	Yes	Mound	Platform and well	No	BA*
TY46	Tipperary	Annaholty	E2312	Yes	No	No	Yes	Spread	No	Yes	MBA–MED
TY47	Tipperary	Annaholty	E2325	Yes	No	No	Mult	Mound	No	No	LBA–IA
TY48	Tipperary	Garraun	E2494	Yes	No	No	No	Spread	No	No	MBA
TY49a	Tipperary	Killalane	E2495	Yes	No	No	Pit	Mound	No	Yes	MBA
TY49b	Tipperary	Killalane	E2495	No	No	No	Mult	Mound	No	No	EM
TY50a	Tipperary	Carrigatogher (Harding	E2406	Yes	Yes	No	No	No	No	No	EM
TY50b	Tipperary	Carrigatogher (Harding	E2406	Yes	No	No	Yes	Spread	No	Yes	LBA
TY51	Tipperary	Carrigatogher (Harding)	E3325	Poss.	No	No	Mult	Spread	No	No	
TY52a	Tipperary	Carrigatogher (Harding)	E2474	Poss.	No	No	Yes	Spread	Cobbled surface, channels	Yes	IA
TY52b	Tipperary	Carrigatogher (Harding)	E2474	Yes	Poss.	No	Yes	Mound	Windbreak, Post-holes	No	LBA
TY52c	Tipperary	Carrigatogher (Harding)	E2474	Yes	No	No	No	Spread	Slot trench?	No	CL
TY53	Tipperary	Carrigatogher (ryan)	E2473	Yes	No	No	Mult	Mound	Cobbled surface	No	CL
TY54	Tipperary	Carrigatogher (Harding)	E2286	Yes	No	No	Yes	Mound	Stake-holes, working surface	No	MBA
TY55a	Tipperary	Ballywilliam	E2479	Yes	No	No	Mult	Spread	Stake-holes	Yes	
TY55b	Tipperary	Ballywilliam	E2479	Poss.	No	No	Yes	Mound	No	No	
TY56	Tipperary	Ballinteenoe	E2902	Yes	No	No	Yes	Spread	No	No	
TY57	Tipperary	Ballytarsna	E2360	Yes	No	No	Yes	Mound	Well	Yes	CL
TY58	Tipperary	Aughnagomaun/ Ashhill	E2361	Yes	No	No	No	Spread	No	No	LBA
TY59	Tipperary	Lahardan Upper & Rathcunikeen	E2371	No	No	No	No	Spread	No	No	
TY60	Tipperary	Rathcunikeen	E2372	Mult	No	No	Mult	Spread	Stake-holes	Yes	MBA
TY61a	Tipperary	Borris	E2378	Yes	No	No	No	Spread	No	No	CL
TY61b	Tipperary	Borris	E2378	Mult	No	No	Yes	Spread	No	No	EBA
TY62	Tipperary	Borris	E2379	Mult	No	No	Mult	Mound	No	No	MBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
TY63a	Tipperary	Inchirourke	E2382	Yes	No	No	Yes	Mound	No	Yes	LBA–IA
TY63b	Tipperary	Inchirourke	E2382	Poss.	No	No	No	Mound	No	No	
TY64a	Tipperary	Fennor	E2385	No	No	No	No	Mound	No	No	
TY64b	Tipperary	Fennor	E2385	Yes	No	No	No	Mound	No	No	CL–EBA
TY65a	Tipperary	Cloughjordan	06E0257	Yes	Yes	Yes	Yes	Mound	Slot-trench structure interpreted as Poss. sweatlodge	No	LBA
TY65b	Tipperary	Cloughjordan	06E0257	Yes	Yes	No	Yes	Mound	Windbreak and stockpile	No	LBA
TY66	Tipperary	Park	E3772	Yes	No	Poss.	Yes	Mound	Well and stake-holes	Yes	MBA
TY67	Tipperary	Greenhills	E3638	Mult	No	No	Mult	Mound	Connected pits	Yes	EBA
TY68	Tipperary	Clashnevin	E3586	Yes	No	No	Mult	Spread	Well	Yes	LBA
TY69	Tipperary	Camlin	E3579	Yes	No	No	Mult	Spread	Well and later ditched enclosure of early medieval date.	Yes	LBA
TY70	Tipperary	Greenhills	E3637	Mult	No	No	Mult	Spread	Stake-holes	Yes	EBA
TY71a	Tipperary	Greenhills	E3658	Mult	No	No	Yes	Spreads	None	Yes	LBA
TY71b	Tipperary	Greenhills	E3658	Mult	No	No	Yes	Spreads	Yes	Yes	EBA–LBA
TE01	Tyrone	Tiroony	AE/06/260	Poss.	Poss.	No	Yes	Mound	No	Yes	MBA
TE02	Tyrone	Agnahoe	AE/08/91	Yes	No	No	No	Mound	No	No	
TE03	Tyrone	Cavankilgreen	AE/08/61	Yes	No	No	No	Mound	No	Yes	
TE04	Tyrone	Drumnafern	AE/08/171	Yes	No	No	Yes	Mound	Well and Poss. timber walkway	Yes	
TE05	Tyrone	Drumnafern	AE/08/170	Mult	No	No	Yes	Mound	No	Yes	
TE06	Tyrone	Golan	AE/08/101	Mult	No	No	Yes	Spread	Water-channels and Poss. stone platforms/ surfaces	Yes	
TE07	Tyrone	Mullaghbane	AE/08/90	Mult	No	Poss.	Yes	Spread	Stake-Holes	Yes	
WD01	Waterford	Clonkerdon	Unknown	Yes	Yes	No	No	Yes	Step feature	No	
WD02	Waterford	Ahanaglogh	98E575	Yes	No	No	No	Yes	Stone Slab	Yes	MBA
WD03	Waterford	Ahanaglogh	98E575	Yes	No	No	No	Spread	Post and Stake-Holes	Yes	CL
WD04	Waterford	Graigueshoneen	98E575	Yes (2)	Yes	No	No	Yes	Stake-Holes and Poss. revetment	No	EBA–LBA
WD05	Waterford	Ahanaglogh	00E192	Yes	No	No	No	Spread	No	No	
WD06	Waterford	Ahanaglogh	00E196	Yes	No	No	Yes	Spread	Well	No	EBA
WD07	Waterford	Graigueshoneen	00E199	Mult	No	Poss.	No	Spread	Stake-Holes	Yes	MBA
WD08	Waterford	Carrignanonshagh	00E198	Yes	Yes (3)	No	No	Spread	Stake-Holes	No	
WD09	Waterford	Scrahane	00E293	Yes	No	No	No	Spread	No	No	LBA
WD10	Waterford	Scrahane	00E197	Yes	No	No	Yes	Spread	Poss. trackway	Yes	
WD11	Waterford	Gracedieu West	03E0588	Yes	No	No	Yes	Yes	Water–channel	Yes	LBA
WD12	Waterford	Woodstown	03E0409	Yes	Yes	No	No	Yes	Water–channel	Yes	LBA
WD13	Waterford	Woodstown	E3436	Mult	No	No	Yes	Spread	Stake-Holes	No	EBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
WD14	Waterford	Killoteran	03E0365	Yes	No	No	Yes	Spread	Post-holes	No	
WD15	Waterford	Killoteran	03E1282	Yes	No	No	Yes	Yes	No	No	LBA–IA
WD16	Waterford	Killoteran	E3827	Yes	No	No	No	Yes	Trackway	No	EBA–MBA
WD17	Waterford	Bawnfune	E3444	Yes	No	No	No	Spread	No	No	LBA
WD18	Waterford	Bawnfune	E3443	Yes	No	No	Mult	Spread	No	No	EBA
WD19	Waterford	Bawnfune	E3442	Yes	No	No	Yes	Spread	Stake-holes	No	IA
WD20	Waterford	Knockhouse Lower	03E0415	Yes	Yes	No	Yes	Yes	Stake-holes	No	
WD21	Waterford	Knockhouse Upper	03E0340	Yes	No	No	No	Spread	No	No	
WD22a	Waterford	Ballyduff East	04E0225	Mult	No	No	No	Spread	No	No	
WD22b	Waterford	Ballyduff East	04E0225	Mult	Yes	No	Yes	Yes	Pathway and Stake-holes	Yes	LBA
WD23	Waterford	Carriganard	03E1176	Mult	No	No	Yes	Yes	Stake-holes	Yes	IA
WD24	Waterford	Glencove	04E0173	Yes	Yes	No	No	Yes	No	Yes	MBA
WD25	Waterford	Seafield	05E1288	Poss.	No	No	No	Spread	Revetment	No	LBA
WD26a	Waterford	Shanakill	06E0277	No	No	No	No	Spread	No	No	LBA
WD26b	Waterford	Shanakill	06E0277	No	No	No	No	Yes	No	No	MBA
WD27	Waterford	Carrickaready	06E0282	Poss.	Yes	No	No	Spread	Hearth pits?	Yes	EBA
WD28	Waterford	Whitestown	06E0281	Yes	No	No	Yes	Spread	No	Yes	LBA
WD29	Waterford	Greenan	06E0280	Yes	No	Poss.	No	Yes	Stake and Post-holes	No	LBA
WD30	Waterford	Ballymaclode	06E0990	Mult	Poss.	No	Yes	Yes	Spring	Yes	LBA
WD31	Waterford	Monamintra	07E0676	Yes	No	No	No	Spread	Stake-holes	Yes	LBA
WM01	Westmeath	Ballybrennan	02E0617	No	No	No	No	Spread	No	No	
WM02	Westmeath	Ballynagarbry	02E0415	Yes	No	No	No	Mounds	No	No	MBA
WM03	Westmeath	Dalystown	02E0774	Yes	Yes	No	No	Mound	Gully and Stake-holes	No	MBA
WM04	Westmeath	Enniscoffey	02E0751	No	No	No	No	Mound	No	No	
WM05	Westmeath	Enniscoffey	02E0902	Yes	Poss.	No	No	Mound	No	No	LN
WM06	Westmeath	Enniscoffey	02E0924	Yes	Poss.	No	No	Mound	Gully	No	EBA
WM07	Westmeath	Griffinstown	02E0935	No	No	No	No	Spread	No	No	
WM08	Westmeath	Kilbalraherd	02E0624	Yes	Yes	No	Mult	Mound	No	No	MBA
WM09	Westmeath	Williamstown	02E0361	Yes	No	No	Yes	Mound	No	No	
WM10	Westmeath	Rathcam/ Lemongrove	02E0922	No	No	No	No	Spread	No	No	
WM11	Westmeath	Syonan	02E0618	No	No	No	No	Spread	No	No	
WM12	Westmeath	Newdown	03E1666	Yes	No	No	No	Mound	No	No	LN
WM13	Westmeath	Newdown	03E1666	Yes	No	No	No	Mound	No	No	EBA
WM14	Westmeath	Heathstown	03E1694	Yes	No	No	Yes	Mound	No	No	EBA
WM15	Westmeath	Heathstown	03E1694	Yes	No	No	No	Mound	No	No	EBA
WM16	Westmeath	Newtown	04E0689	Mult	No	No	No	Mound	Post–hole	No	EBA–MBA
WM17	Westmeath	Newtown	04E0691	Yes	Yes	No	Yes	Mound	Fire pit	Yes	MBA
WM18	Westmeath	Marlinstown	04E0688	Yes	No	No	No	Mound	Post-holes	No	EBA
WM19	Westmeath	Newtown	04E0690	No	No	No	No	Spread	No	No	LBA
WM20	Westmeath	Kiltotan and Collinstown	E2768	Poss.	No	No	Mult	Spread	No	Yes	EBA

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
WM21	Westmeath	Seeoge	E2635	Mult	Poss.	Yes	Yes	Mound	Well and Stake-Holes	Yes	LBA
WM22	Westmeath	Seeoge	E2664	No	No	No	No	Spread	No	No	MBA
WM23	Westmeath	Creggan Lower	E2664	No	No	No	Yes	Spread	Stake-Holes	Yes	LBA
WM24	Westmeath	Boyanaghcalry	E2663	Yes	No	No	No	Spread	No	No	MBA
WM25a	Westmeath	Williamstown	E2660	Yes	No	No	Yes	Mound	No	Yes	MBA
WM25b	Westmeath	Williamstown	E2660	No	No	No	Yes	Spread	No	No	
WM26	Westmeath	Williamstown	E2704	Yes	No	No	Yes	Spread	Water-channel	No	LBA
WM27	Westmeath	Aghafin	E2665	Yes	No	Poss.	No	Mound	Stake-Holes	No	LBA
WM28	Westmeath	Cregganmacar	E2666	Yes	No	Poss.	No	Spread	Post-Holes	No	IA
WM29	Westmeath	Cregganmacar	E2667	Yes	No	No	Yes	Spread	No	No	LBA
WM30	Westmeath	Cregganmacar	E2703	No	No	No	No	Spread	No	No	EBA
WM31	Westmeath	Cregganmacar	E2668	Yes	No	No	No	Mound	Post–Hole	No	MBA–LBA
WM32	Westmeath	Kilbeg	E2688	Yes	No	No	Yes	Spread	Well/cistern	No	LBA
WM33	Westmeath	Kilbeg	E2689	No	No	No	No	Mound	No	No	MBA
WM34a	Westmeath	Kilbeg	E2691	Yes	No	No	Mult	Mound	Water–channels	No	EBA–LBA
WM34b	Westmeath	Kilbeg	E2691	Yes	No	No	No	Mound	Water–channel and Post-Holes	No	EBA
WM35	Westmeath	Kilbeg	E2691	Yes	No	No	No	Mound	Stockpile?	Yes	EBA
WM36	Westmeath	Kilbeg	E2691	No	No	No	No	Mound	No	Yes	EBA
WM37a	Westmeath	Kilbeg	E2691	Yes	No	No	No	Spread	No	No	
WM37b	Westmeath	Kilbeg	E2691	Yes	No	No	No	Spread	No	No	EBA
WM38a	Westmeath	Kilbeg	E2692	Yes	Yes	Poss.	Mult	Spread	Stockpile	No	MBA
WM38b	Westmeath	Kilbeg	E2692	Yes	No	No	Yes	Spread	Well and water–channel	No	LBA
WM38c	Westmeath	Kilbeg	E2691	Yes	No	No	No	Spread	No	No	EBA
WM39	Westmeath	Kilbeg	E2693	Mult	No	No	Yes	Spread	Water–channel	No	LN–EBA
WM40	Westmeath	Kilbeg	E2694	Yes	Yes	Yes	Yes	Mound	Oven, working surface/ platform and causeway	Yes	EBA
WM41a	Westmeath	Correagh	E3374	Mult	No	No	Yes	Mound	Timber water–channel	Yes	EBA
WM41b	Westmeath	Correagh	E3374	Yes	No	No	Mult	Spread	No	Yes	MBA
WM42	Westmeath	Kilgaroan	E2700	Yes	No	No	Mult	Spread	Post-Holes	No	EBA–EM
WM43	Westmeath	Ballinderry Big	E3275	Yes	No	Yes	Yes	Mound	Stake-Holes	No	EBA
WM44	Westmeath	Tonaphort	E3278	Yes	No	No	Mult	Mound	No	No	MBA
WM45	Westmeath	Kilbeggan South	E3282	Poss.	No	No	Mult	Spread	No	No	EBA
WM46	Westmeath	Macetown	06E0610	Yes	No	No	Yes	Spread	Large pit/ cistern	No	
WM47	Westmeath	Ardnaglew	E2709	No	No	No	No	Spread	No	No	EBA
WM48	Westmeath	Ballykilmore	E2711	Yes	Poss.	No	Yes	Spread	No	No	EBA–IA
WM49a	Westmeath	Ballykilmore	E2717	No	No	No	No	Mound	Platform	No	EBA
WM49b	Westmeath	Ballykilmore	E2717	No	No	No	Yes	Spread	No	No	MBA
WM49c	Westmeath	Ballykilmore	E2717	No	No	No	Yes	Mound	No	No	MN
WM49d	Westmeath	Ballykilmore	E2717	No	No	No	Yes	Spread	No	No	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
WM49e	Westmeath	Ballykilmore	E2717	No	No	No	No	Spread	No	No	
WM50	Westmeath	Cappanrush	E2722	No	No	No	Poss.	Mound	No	No	MN
WM51	Westmeath	Cornaher	E2731	No	No	No	Yes	Spread	No	No	LBA
WM52	Westmeath	Mearsparkfarm	E2734	Yes	Yes	No	Yes	Spread	Stake-Holes	No	MBA
WM53	Westmeath	Mearsparkfarm	E2735	Mult	No	No	No	Spread	Water–channel	No	LBA
WM54	Westmeath	Mearsparkfarm	E2736	Yes	No	No	No	Mound	No	No	MBA
WM55	Westmeath	Mearsparkfarm	E2742	Yes	Poss.	No	Yes	Spread	Well	No	EBA–LBA
WM56	Westmeath	Hallsfarm	E2749	Yes	No	No	Yes	Spread	Medieval pits	No	EBA–IA
WM57	Westmeath	Hallsfarm	E2750	Yes	No	No	Yes	Spread	Medieval pits	No	EBA
WM58	Westmeath	Kilavally	E2766	Yes	No	No	Yes	Mound	Well	No	MBA
WM59	Westmeath	Skeahanagh	E2789	No	No	No	Yes	Spread	Platform/ working surface?	Yes	EBA
WM60a	Westmeath	Stonehouse Farm	E2796	Mult	Yes (2)	Poss.	Yes	Mound	Windbreak?/ revetment	No	MBA
WM60b	Westmeath	Stonehouse Farm	E2796	Yes	No	No	No	Spread	No	Yes	
WX01	Wexford	Dungeer	00E0474	Yes	No	No	No	Spread	Stake-Holes	No	IA
WX02	Wexford	Ballyvergin	00E0473	Yes	Yes	No	Yes	Spread	Stake-Holes	No	MBA
WX03	Wexford	Strandfield	02E0411	Yes	No	No	Yes	Mound	Windbreak	Yes	
WX04	Wexford	Coolamurry	04E0325	Poss.	No	No	Mult	Spread	No	No	
WX05	Wexford	Ask	E3500	Yes	No	No	Yes	Yes	Metalled surface and Stake-Holes	Yes	EBA
WX06	Wexford	Ask	E3501	Yes	No	Poss.	Yes	Yes	Poss. well/ cistern and Stake-Holes	Yes	MBA–IA
WX07	Wexford	Ballyellin	E3509	Yes	No	Poss.	Yes	Spread	Stake-Holes	Yes	EBA–LBA
WX08	Wexford	Ballyellin	E3510	Yes	No	No	Yes	Spread	Stake-Holes	Yes	EBA
WX09	Wexford	Ballyloughan	E3494	Yes	Poss.	No	Yes	Yes	Stake-Holes	Yes	EBA
WX10	Wexford	Clogh	E3468	Mult	No	No	Yes	Spread	No	Yes	EBA
WX11	Wexford	Clogh	E3469	Yes	No	No	No	Yes	Stake-Holes	No	LBA
WX12	Wexford	Coolnastudd	E3481	Mult	No	No	No	Spread	No	Yes	CL
WX13	Wexford	Coolnastudd	E3481	No	Yes	No	No	Spread	Poss. oven	No	CL
WX14	Wexford	Courteencurragh	E3493	Yes	No	No	No	Spread	Stake-Holes	Yes	CL
WX15	Wexford	Killybegs	E3507	Yes	Yes	No	No	Spread	No	Yes	MBA–LBA
WX16	Wexford	Moneycross Upper	E3472	Yes	Yes	No	Yes	Spread	Clay platform	No	LBA–IA
WX17	Wexford	Moneycross Upper	E3474	No	No	No	Mult	No	No	No	CL
WX18a	Wexford	Parkbaun	E3504	Yes	Yes	No	No	Spread	No	No	EBA
WX18b	Wexford	Parkbaun	E3504	Yes	No	No	No	Spread	Charred timbers	Yes	EBA
WX19	Wexford	Raheenagurren West	E3488	Yes	No	No	Yes	Spread	Post-Holes	Yes	IA
WX20	Wexford	Raheenagurren West	E3489	Mult	No	Poss.	No	Yes	Stake-Holes	Yes	LBA
WX21a	Wexford	Raheenagurren West	E3490	Yes	No	No	No	Spread	No	Yes	
WX21b	Wexford	Raheenagurren West	E3490	Yes	No	No	No	Spread	No	Yes	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
WX21c	Wexford	Raheenagurren West	E3490	Yes	No	Poss.	Yes	Spread	Stake-Holes	Yes	EBA
WX22	Wexford	Tinnock Lower	E3503	No	No	No	Mult	No	No	Yes	EMA–MBA
WW01	Wicklow	Ballyremon Commons	E206	Yes	No	No	No	Spread	No	No	EBA
WW02	Wicklow	Kilnacarrig	93E0001	Yes	No	No	No	Spread	Stake-Holes	No	EBA
WW03	Wicklow	Kilnacarrig	93E001	Mult	Yes	No	Yes	Mound	Stake-holes	No	MBA–EBA
WW04	Wicklow	Ballynattin	97E0128	Yes	No	No	No	Spreads	No	Yes	LBA
WW05	Wicklow	Johnstown North	97E0252	Yes	No	No	Yes	Spreads	No	Yes	
WW06	Wicklow	Ballynamuddagh	00E0398	No	No	No	No	Mound	No	No	
WW07a	Wicklow	Rathmore	01E471	No	No	No	No	Mound	No	No	
WW07b	Wicklow	Rathmore	01E471	Yes	Poss.	No	Yes	Mound	Stake-Holes and Poss. oven?	No	
WW07c	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW07d	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW07e	Wicklow	Rathmore	01E471	No	No	No	No	Mound	No	No	
WW07f	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	Stake-holes	No	
WW07g	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW07h	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW07i	Wicklow	Rathmore	01E471	Yes	No	No	Yes	Mound	Stake-Holes	Yes	
WW07j	Wicklow	Rathmore	01E471	Yes	Poss.	No	Yes	Mound	No	Yes	
WW07k	Wicklow	Rathmore	01E471	No	No	No	No	Spread	No	No	
WW07L	Wicklow	Rathmore	01E471	Yes	Poss.	No	No	Mound	No	No	
WW07m	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	Stake-Holes	No	
WW07n	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW07o	Wicklow	Rathmore	01E471	Yes	No	No	No	Spread	No	No	
WW07p	Wicklow	Rathmore	01E471	Yes	No	No	No	Mound	No	No	
WW08	Wicklow	Ballyhenry	01E0654	Mult	No	No	No	Mound	No	No	
WW09	Wicklow	Ballyhenry	01E0655	Yes	No	No	No	Mound	No	No	
WW10	Wicklow	Barnacoyle Big	01E0822	No	No	No	No	Spread	Streambed	Yes	
WW11	Wicklow	Downshill	01E0574	No	No	No	No	Spread	Post-hole	No	
WW12	Wicklow	Calary Lower	01E0575	No	No	No	Yes	Spread	No	No	
WW13	Wicklow	Cronykeery	01E0404	Yes	Poss.	No	Yes	Spread	Stake-holes, Poss. windbreak structure	No	
WW14	Wicklow	Kilmacanogue	01E0571	No	No	No	Yes	Spread	No	No	
WW15	Wicklow	Kimartin	01E0435	Yes	Yes	No	Yes	Spreads	Large pit/Poss. well feature	No	
WW16	Wicklow	Tiglin	01E0505	Poss.	No	No	Mult	Spreads	No	Yes	
WW17	Wicklow	Ballyhenry	01E1222	No	No	No	No	Mound	No	No	
WW18	Wicklow	Ballynabarny	01E0904	Yes	Poss.	No	Yes	Spread	Spring, Poss. roasting pit and stake-structures/ windbreaks	No	
WW19a	Wicklow	Ballynabarny	02E0170	Yes	No	No	No	Mound	No	No	

Cat. Number	County	Townland	Licence	Trough	Hearth	Structure	Pits	Deposit	Other Features	Artefacts	Period
WW19b	Wicklow	Ballynabarny	02E0170	Yes	No	No	No	Mound	No	No	
WW19c	Wicklow	Ballynabarny	02E0170	No	No	No	No	Spread	No	No	
WW20	Wicklow	Kiltimon	02E0605	No	Yes	No	No	Mound	Platform	No	
WW21	Wicklow	Ballyhenry	03E1353	No	No	No	No	Mound	No	No	
WW22	Wicklow	Charlesland	03E0592	Mult	No	No	Yes	Spread	Stake-holes	Yes	EBA
WW23	Wicklow	Charlesland	03E1645	Mult	No	No	Yes	Spread	Stake-holes	Yes	
WW24	Wicklow	Killincarrig	03E1399	Yes	No	Poss.	No	Spreads	No	No	
WW25	Wicklow	Ballynattin	05E0741	No	No	No	No	Mound	Post-holes	No	
WW26	Wicklow	Inchanappa South	04E1717	Yes	No	No	Yes	Mounds	No	No	CL–EBA
WW27	Wicklow	Rampere	05E0472	Yes	No	No	No	Mound	Post-holes	Yes	MBA
WW28	Wicklow	Ballinaskea	E3202	Yes	Poss.	No	Yes	Spreads	No	Yes	EBA–MBA
WW29	Wicklow	Scratenagh	E3206	Yes	Yes	No	Yes	Spread	Stake-holes	Yes	CL
WW30	Wicklow	Scratenagh	E3207	Yes	No	No	No	Spread	No	No	MBA
WW31	Wicklow	Scratenagh	E3208	No	No	No	Yes	Spread	Stake-holes and isolated Iron Age pit	Yes	
WW32	Wicklow	Scratenagh	E3209	Yes	Yes	No	Yes	No	Post-holes	Yes	LN–CL
WW33	Wicklow	Scratenagh	E3211	Yes	Yes	No	Yes	Spread	Large pit/ water-hole?	No	LBA
WW34	Wicklow	Cranagh	E3217	Yes	No	No	Yes	Spread	No	Yes	EBA
WW35a	Wicklow	Ballynapark	E3220	Mult	No	No	Mult	Mound	Cobbled surface	Yes	
WW35b	Wicklow	Ballynapark	E3220	Yes	No	No	Mult	Spreads	No	Yes	EBA
WW36	Wicklow	Ballynapark	E3222	No	No	No	No	Spread	No	No	
WW37a	Wicklow	Ballynapark	E3223	Yes	No	No	Yes	Spread	No	Yes	MBA
WW37b	Wicklow	Ballynapark	E3223	No	No	No	Yes	Spread	No	No	
WW38	Wicklow	Cloghoge	E3224	No	No	No	No	Spread	No	Yes	
WW39	Wicklow	Ballyclogh South	E3226	No	No	No	Yes	Spread	No	Yes	
WW40a	Wicklow	Ballyclogh North	E3227	Yes	No	No	No	Mound	No	No	EBA
WW40b	Wicklow	Ballyclogh North	E3227	Yes	No	No	Yes	Mound	No	Yes	No
WW41	Wicklow	Ballyclogh North	E3229	Yes	No	No	Yes	Mound	Timber platform	Yes	MBA
WW42a	Wicklow	Ballyclogh North	E3230	Yes	No	No	No	Mound	No	Yes	
WW42b	Wicklow	Ballyclogh North	E3230	Yes	No	No	No	Mound	No	No	EBA
WW43	Wicklow	Ballyclogh North	E3231	Yes	No	No	Yes	Mounds	Timber platform, stone surface, windbreak and Water-channel	Yes	MBA–LBA
WW44a	Wicklow	Ballyclogh North	E3232	Yes	No	No	Yes	Mound	Stone surface and pit	Yes	
WW44b	Wicklow	Ballyclogh North	E3232	Yes	No	No	No	Spread	No	Yes	LBA
WW45	Wicklow	Kilmurry South	E3233	Yes	No	No	No	Spread	No	No	
WW46	Wicklow	Kilmurry South	E2334	Yes	No	No	Yes	Mound	Pit with worked timbers	Yes	
WW47	Wicklow	Kilmurry North	E2326	Yes	Yes	No	Yes	Mound	Knapping area	Yes	CL
WW48	Wicklow	Ballyvaltron	E3238	Yes	No	No	Yes	Spread	No	No	LBA

Cat. Number	COUNTY	TOWNLAND	LICENCE	TROUGH	HEARTH	STRUCTURE	PITS	DEPOSIT	OTHER FEATURES	ARTEFACTS	PERIOD
WW49	WICKLOW	BALLYVALTRON	E3239	YES	POSS.	NO	MULT	SPREAD	POSS. KILN	NO	EBA–MBA
WW50	WICKLOW	COOLACORK	E3247	MULT	YES	NO	YES	SPREAD	STONE SURFACE AND PLATFORM	YES	CL
WW51	WICKLOW	ROSCATCH	E2349	YES	MULT	NO	MULT	NO	NO	YES	LBA